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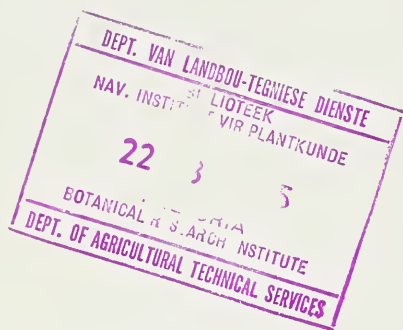


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PRETORIA  
INDEX TO VOL. VII



EDITED BY

R. A. DYER, M.Sc., D.Sc., F.R.S.S.Af.,

CHIEF, DIVISION OF BOTANY, DEPARTMENT OF AGRICULTURAL AND TECHNICAL SERVICES  
AND DIRECTOR OF THE BOTANICAL SURVEY OF THE REPUBLIC OF SOUTH AFRICA

THE GOVERNMENT PRINTER, PRETORIA



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# Leaf Anatomy in the Grass Series Phragmitiformes (Harz) Avdulov.

By

J. M. J. de Wet.

The taxonomy of the Gramineae is by no means straightforward and is complicated by many factors. Due largely to a lack of data there is still no general agreement regarding the subdivision of the family into tribes or even subfamilies. The flowers are not showy, the component parts are often much reduced and the vegetative parts have reached a high degree of specialization. A close examination of the glumes, lemmas, paleae, lodicules, androecium and gynoecium reveals a wide degree of diversity among these organs. It is, therefore, not surprising that most systems of classification are based mainly on spikelet morphology. Recently, however, evidence regarding the relations of the species and genera has become available which differs conspicuously from most older observations. Leaf anatomy (Duval-Jouve, 1875, Pee-Laby, 1898, Grob, 1895-1897 and Prat, 1932, 1936) was proved to be useful in grass taxonomy. Similarly, Avdulov (1931) and Hunter (1934) indicated a close correlation between cytological data and the physiological observations of Trucel (1858) and Harz (1880-1882). More recently, Reeder (1946, 1953) combining with his own observations the data of Burns (1892) and Kennedy (1899) indicated that embryo anatomical observations may be used taxonomically. Reeder and von Maltzan (1953) also pointed out that different types of root hair development were observed which allow for a subdivision of the Gramineae on the same lines as pointed out by Avdulov (1931) and Prat (1936). It is generally agreed among modern taxonomists that anatomy, cytology, genetics, ecology and physiology provide more reliable clues towards the true relationships in the Gramineae than spikelet morphology alone. Subdivisions based on gross morphology is essential for the easy and rapid identification of individual plants. Such is the recent classification of Pilger (1954). The leaf anatomy of the genera included in his subfamilies Festucoideae Hitchc., Micrairoideae Pilger, Oryzoideae Parodi, Olyroideae Pilger, Bambusoideae Krause and Anomochloideae Pilger will be discussed. An attempt will be made to evaluate the available data and supplement them with some personal observations in determining the phylogenetic position of some genera of controversial affinity.

The terms Panicoid type, Festucoid type, Eragrostoid type and Oryzoid type of internal leaf anatomy and epidermal histology were fully discussed by Prat (1936) and de Wet (1954, 1956a). The reader is referred to the diagrams later in this paper for more details.

**MATERIAL AND METHODS:** Specimens investigated were obtained from the National Herbarium, Pretoria. Slides were prepared according to the procedure outlined by Prat (1948). Drawings were made with the aid of a Camera Lucida.

## Subfamily FESTUCOIDEAE.

1. **Festuceae – Festucinae:** *Lintonia* and *Cynosurus* were found to be Festucoid in all respects. The genera *Urochloa*, *Lasiachloa* and *Plagiachloa* are characterized by the Festucoid type of internal leaf anatomy and the Panicoid type of epidermis. They are further characterized by truncate lodicules and ciliated ligules.

The genera *Lamarckia*, *Briza*, *Dactylis*, *Poa*, *Nephelochloa*, *Cutandia*, *Scleropoa*, *Vulpia* and *Festuca* are Festucoid in all respects according to Prat (1936). Prat (1936) also indicated a Panicoid type of leaf anatomy for *Uniola* and *Distichlis*, and a Festucoid type of chlorophyll distribution with variable epidermal traits in *Aeluropus* and *Fingerhutia*. Moffet and Hurcombe (1949) demonstrated a Eragrostoid type of leaf anatomy and cytology for *Tetrachne*.

**Festuceae – Triodinae:** *Plectrachne* and *Notochloa* are unknown cytologically and anatomically. Brown (1950) refers *Astrebula* to the Chlorideae because of its small chromosomes and basic number of  $n = 10$ . *Triodia* is characterized by  $n = 8$  (Brown, 1950) and Burbidge (1946) demonstrated a Festucoid type of leaf anatomy.

**Festuceae – Sesleriinae:** The leaf anatomy of *Entoplocamia* and *Orcuttia* is of the Eragrostoid type. They are further characterized by ciliated ligules, large embryos and the grains are loosely enclosed by the lemmas and palea. Prat (1936) demonstrates a Festucoid type of epidermis and internal anatomy for the genera *Sesleria* and *Echinaria*. Myers (1947) lists large chromosomes with basic numbers  $n = 7$  and  $n = 9$  in these genera respectively. No data regarding chromosomes, anatomy and lodicules are available for the remaining genera included in this subtribe.

**Festuceae – Beckmanniinae:** Includes a single genus *Beckmannia* usually referred to the Chlorideae. Von Tieghem (1897), Avdulov (1931), Prat (1936) and Krishnaswamy (1941) indicated relations with the tribe Agrostae as recognized by Hubbard (1934). Reeder (1953) studied the embryo anatomy and indicates relations with the genera *Alopecurus*, *Phleum* and *Polypogon*.

**Festuceae – Melicinae:** Only two of the genera included in this subtribe have been studied. Morphologically *Melica* and *Schizachne* differ from the Festuceae in spikelet morphology. Their lodicules are truncate and vasculated, their stigma branches are broad and dichotomous, their caryopsis do not adhere to the palea and their embryos are relatively large. Both genera are characterized by the Panicoid type of histology. In the case of *Melica*, Avdulov (1931) demonstrated large chromosomes in multiples of  $n = 9$ .

**Festuceae – Glyceriinae:** *Pleuropogon* and *Glyceria* resemble the Festuceae in superficial characters but do not seem to be related to members of Festuceae. The chromosomes are medium large and Avdulov (1931) demonstrated  $n = 9$  in *Glyceria* and  $n = 8$  in *Pleuropogon*. Leaf anatomy is of the Festucoid type. *Poa* has been transferred by de Wet (1956a) to the Danthonieae. The genus *Puccinella* on the other hand is Festucoid in all respects (Prat, 1936). Furthermore, in the latter genus the lodicules have appendages, the embryo is small and the grain is tightly embraced by the hardened lemma and palea.

**Festuceae – Psilurinae:** The single genus *Psilurus* is characterized by a Festucoid type of leaf anatomy (Prat, 1936) and Avdulov (1931) demonstrated large chromosomes and a basic number of  $n = 7$ . Hubbard (1934) includes *Psilurus* together with *Pholiurus*, *Lepturus* and *Ischnurus* in the tribe Leptureae. Prat (1936) demonstrated that this tribe as recognized by Hubbard (1934) is completely Festucoid in all respects. Pilger (1954) retains *Pholiurus* in the subfamily Festucoideae tribe Monermeae. *Lepturus* and *Ischnurus*, however, Pilger (1954) refers to the Chlorideae, which evidently is incorrect.

**Festuceae – Loliinae:** Includes a single genus *Lolium* which is Festucoid in all respects. The cytology was investigated by Faworski (1927) and leaf anatomy by Prat (1936).

**Festuceae – Brominae:** A truly Festucoid tribe according to Avdulov (1931), Prat (1936) and Myers (1947).

**Festuceae – Streptogyninae:** The single genus *Streptogyne* is unknown cytologically and anatomically.



**Festuceae – Centothecinae:** Both Pilger (1954) and Hubbard (1934) regards the Centothecinae as a subtribe of the Festuceae. It definitely does not belong here. Prat (1936) illustrates an Oryzoid type of leaf epidermis for *Centotheca*, *Lophatherum* and *Zeugites*. On the other hand, *Orthoclada* was found to have the Panicoid type of epidermis. Chlorophyll distribution is of the Festucoid type in all these genera. Avdulov (1931) demonstrated  $n = 12$  in *Centotheca*, a cytology quite foreign to the Festuceae. In *Centotheca* the ligule is scarious, a Festucoid type of character, but the two lodicules are cuneate and without appendages which again are Panicoid characteristics.

**Festuceae – Pommercullinae:** The genus *Pommerculla* has not been studied.

**Festuceae – Monanthochloinae:** The single genus *Monanthochloe* is characterized by the Festucoid type of leaf anatomy but it differs from the Festuceae in spikelet morphology. The lodicules are truncate and the stigma branches are elongated.

**2. Triticeae – Henrardiinae:** The genus *Henrardia* is unknown cytologically and anatomically.

**Triticeae – Eutriticinae:** Prat (1936) and Avdulov (1931) indicated that the genera included in this tribe are characterized by all the peculiarities typical of the subfamily Festucoideae.

**3. Monermeae:** Only *Pholiurus* of the genera included in this tribe is known cytologically and anatomically. Prat (1936) indicated that this genus is Festucoid in all respects.

**4. Aveneae – Aveninae:** This subtribe has been fully discussed by de Wet (1954, 1956a). *Schismus*, *Afrachneria* and *Prionanthium* occupy an artificial position in the Aveneae.

**Aveneae – Duthiinae:** The single genus *Duthiea* has not been studied.

**Aveneae – Danthoniinae:** This subtribe was discussed by de Wet (1956a). A number of the genera included in this subtribe are still unknown anatomically and cytologically. Their phylogenetic position in the Gramineae is still uncertain.

**5. Arundineae:** A primitive tribe closely allied to the Danthoniinae (de Wet, 1956a). The morphological characters are peculiar and differ from those of typical members belonging to the subfamily Festucoideae. The lemmas are primitively awned from the sinus of the lobes, the ligule is ciliated, lodicules are more or less cuneate and vasculated and the stigma branches tend to be expanded and flattened in most species. Avdulov (1931) indicated a basic chromosome number of  $n = 12$ . Leaf anatomy, Prat (1936) and de Wet (1954) is of the Panicoid type.

**6. Arundinelleae:** The genera *Arundinella*, *Trichopteryx*, *Loudetia* and *Tristachya* are Panicoid in respect to leaf anatomy and morphology but resemble the Phragmitiformes of Avdulov (1931) in cytology (de Wet, 1954). *Danthoniopsis* on the other hand according to de Wet (1954) is Panicoid in all respects. The genus *Gilgichloa* has not been investigated.

**7. Thysanolaeneae:** The single genus *Thysanolaena* is characterized by the Panicoid type of epidermis and chlorophyll distribution. It is also Panicoid in respect of the grain which is free from the lemma and palea, the large embryo and lodicules which are cuneate. Typical Festucoid characters are the disarticulation of the spikelet above the glumes and the scarious rim which forms the ligule.

**8. Phalarideae:** *Ehrharta* and *Microlaena* are characterized by the Oryzoid type of leaf anatomy (Prat, 1936) and cytology (Avdulov, 1931). The remaining genera, Prat (1936), are typically Festucoid.

9. **Pappophoreae**: In the genera *Schmidtia* and *Enneapogon* the siliceous cells are Panicoid but the bicellular hairs are typically *Eragrostoid*. Prat (1936) recorded an *Eragrostoid* type of epidermis of *Cottea* and *Pappophorum*. Chlorophyll distribution is of the Festucoid type.

Small chromosomes and a basic number of  $n = 10$  were recorded by Covas (1945) in the genera *Cottea* and *Pappophorum*. For the genera *Schmidtia* and *Enneapogon* de Wet (1956b) demonstrated a basic chromosome number of  $n = 9$ . In the latter two genera the stigma branches are stalked, the lodicules are cuneate and the embryo occupies  $\frac{3}{4}$  or more of the length of the grain.

10. **Stipeae**: The chromosomes are mostly small but medium large in *Piptochaetium* and a few species of *Stipa*. The basic chromosome numbers are  $n = 11$  in *Piptochaetium* and some species of *Oryzopsis*, while  $n = 12$  in some other species of the latter genus (Johnson, 1945). In *Stipa*, Myers (1947), Brown (1949, 1951) and Ono and Tateoka (1953) demonstrate an aneuploid series, perhaps originally derived from  $n = 6$  or  $n = 5$ . Internal leaf anatomy is of the Festucoid type and epidermal traits are variable (Prat, 1936).

11. **Nardeae**: Prat (1936) demonstrated a Festucoid type of chlorophyll distribution and *Eragrostoid* type of epidermis. Avdulov (1931) observed a basic chromosome number of  $n = 13$  in the monotypic genus *Nardus stricta*.

12. **Coleanthaeae**: The single genus *Coleanthus* is *Eragrostoid* in respect of leaf anatomy. Lack of material made it impossible to study spikelet morphology.

13. **Lygeae**: The monotypic genus *Lygaeum sparteum* has  $n = 20$  and medium large chromosomes (Myers, 1947). Leaf anatomy is unknown.

14. **Phyllorachieae**: The genera included in this tribe were fully discussed by de Wet (1956b). It was pointed out that this tribe is closely related to the Oryzeae.

15. **Parianeae**: Contains a single tropical New World genus *Pariana* which is unknown anatomically and cytologically.

Subfamily MICRAROIDEAE: Tribe **Micraireae**: Includes a single genus *Micraira* which was not available for study.

Subfamily ORYZOIDEAE: Tribe **Oryzeae**: The genera *Oryza*, *Leersia*, *Potamophila* and *Zizania* are all characterized by the Oryzoid type of epidermis and Festucoid type of chlorophyll distribution. Kuwado (1910) and Ramanujam (1938) demonstrated a basic chromosome number of  $n = 12$  in *Oryza*. A similar basic chromosome number and medium large chromosomes are also present in *Leersia* (Ramanujam, 1938). The remaining genera included by Pilger (1954) in this subfamily are unknown anatomically and cytologically.

Subfamily OLYROIDEAE: Tribe **Olyreae**: The genera *Pharus* and *Leptaspis* are characterized by the Panicoid type of epidermis. These genera are included by Hubbard (1934) in the tribe Phareae. Of the other genera belonging to the Olyreae, *Raddia*, *Lithachne* and *Olyra* are characterized by the Oryzoid type of epidermis. Chlorophyll is distributed according to the Festucoid type in all genera investigated.

Subfamily BAMBUSOIDEAE: This subfamily has been fully investigated by Prat (1936) who indicated a very peculiar type of leaf anatomy. Pilger (1954) also includes the tribe Streptochaetaeae of Hubbard (1934) in this subfamily. The genus *Streptochaeta*, the only member of this tribe, has not been studied anatomically. Stebbins (Unpubl.) reports  $n = 11$  chromosomes in one of the two known species of this genus.

Subfamily ANOMOCHLOIDEAE: This includes a single genus, *Anomochloa*. No data regarding cytology, anatomy or detailed spikelet morphology is available.

One tribe of the subfamily Eragrostoideae the Aristideae as recognized by Pilger (1954) also needs to be mentioned. Pilger (1954) includes the genera *Aristida*, *Amphipogon* and *Diplopogon* in this tribe. Only the genus *Aristida* was available for study. The basic chromosome number is  $n = 11$  and  $n = 12$  in *Aristida* according to de Wet (1954, 1956b). A further indication that this genus does not belong in the Eragrostoideae comes from a study of leaf anatomy. The chlorophyll distribution is of the Panicoid type, but epidermal traits are variable. For instance in *A. ciliata* it is Eragrostoid, in *A. barbicollis*, *A. bipartita* and *A. aequiglumis* the epidermis is of the Panicoid type and in species such as *A. gracilior*, *A. obtusa* and *A. sericans* the epidermis is typically of the Festucoid type.

SUBDIVISION OF THE PHRAGMITIFORMES: The family Gramineae has been subdivided at various times into two or more subfamilies or series. As early as 1810, Brown noted two main groups, the Panicoideae and Pooideae. Pilger (1954) recognizes nine subfamilies. Combining the evidence presented by Harz (1880-1882), Avdulov (1939), Prat (1936) and the data presented by numerous taxonomists on spikelet morphology at least four series become evident. The characteristics of these, the Phragmitiformes, Paniciformes, Eragrostiformes and Festuciformes were discussed by de Wet (1954).

The subfamily Festucoideae as recognized by Pilger (1954) includes a diverse group of species and genera. In the classification of the Gramineae the true Panicoids, true Festucoids and the true Eragrostoid-chloridoids constitute no problem. A number of tribes and genera, however, do not belong to any one of these distinct groups and these are lumped together into a miscellaneous series the Phragmitiformes (Avdulov, 1931). The more outstanding tribes and genera involved are discussed below. Their position in grass phylogeny was pointed out by Stebbins (1956).

1. **Streptochaeteae:** Includes a single tropical genus, *Streptochaeta*. It has 3 lodicules, 6 stamens, 3 stigmas and the palea is split nearly to the base. Benthams (1881) refers this genus to the Paniceae and Hackel (1889) to the Oryzeae. Hubbard (1934) indicates that it is distinct from both these tribes.

2. **Bamuseae:** The genera are distributed throughout the tropics and subtropics. A few genera extend into the temperate regions. As pointed out by Hubbard (1934) it includes genera with the most primitive floral structure, but they are highly specialized vegetatively. Spikelets are all alike, lemmas awnless or rarely awned from the tip, lodicules usually 3, and 3, 6 or more stamens are present. Most of the species studied are high polyploids on the basis of  $n = 12$  (Myers, 1947). Hunter (1934) indicates  $n = 9$  in a species of *Arundinaria*. Internal leaf anatomy, Prat (1936) is characteristic. Epidermal traits are variable, but more or less of the Panicoid type.

3. **Phareae:** This is a tropical tribe, probably of close common ancestry with the Bamuseae. As is recognized by Hubbard (1934) the genera *Pharus* and *Lectaspis* are included. The spikelets are 1-flowered, awnless and unisexual. The lodicules are mostly 3, stigmas 3 and stamens 6. The chromosomes are small and the basic number is  $n = 12$  (Valencia ex Stebbins unpublished). The leaf anatomy is Panicoid.

4. **Olyreae:** This tribe differs from the Phareae in the reduction of the stamens to 3 or 2 and in the Oryzoid type of epidermis. It includes the genera as recognized by Hubbard (1934).

5. **Centotheceae:** Anatomical characters are Festucoid in respect to chlorophyll distribution, but the epidermal traits are either Panicoid or Oryzoid. This tribe is recognized to include the genera *Centothea*, *Lophatherum*, *Zeugites*, *Orthoclada* and *Magastachya*. Both Hubbard (1934) and Pilger (1954) combine these genera as a subtribe of the Festuceae.



6. **Parianeae:** Contains a single New world genus which was not studied. Hubbard (1934) indicates that *Pariana* resembles the *Hordeae* in superficial inflorescence characters. This genus appears to present a highly specialized end line.

7. **Anomochloae:** This tribe is recognized in the sense of Hubbard (1934) to include *Anomochloa merantoidea* of the Brazilian forest. This genus is incompletely known and it shows no close affinity with any other genus.

8. **Phyllorachieae:** Chlorophyll distribution is of the Festucoid type, epidermis of the Oryzoid type and the chromosomes are small in multiples of  $n = 12$ . As was done by Hubbard (1939) the genera *Phyllorachis* and *Humbertochloa* are included. This tribe resembles the Oryzeae closely not only in anatomy and cytology, but also in spikelet morphology and starch grains. For this reason it would appear as if they developed from a common stock and might well be united.

9. **Oryzeae:** The genera *Ehrharta*, *Microlaena* and *Tetrarrhena* should be added to the tribe as recognized by Hubbard (1934). The starch grains are angular, the chromosomes small and in multiples of 12 and the leaf anatomy is typical. *Ehrharta*, *Microlaena* and *Tetrarrhena* are southern in distribution and represent the most primitive members of the tribe. The tribe as a whole has reached a high degree of specialization in the tropics.

10. **Arundineae:** Is a very large tribe. To the genera included by Pilger (1954), the tribe Danthonieae as recognized by de Wet (1956a) could be added. In other words, as recognized by Pilger (1954) the subtribe *Danthoniinae* of the Aveneae, the genera *Schismus*, *Afrachueria* and *Prionothium* of the Aveneae subtribe Aveninae and from the Festuceae subtribe Glyceriinae the genus *Poagrostis*. Further also the genera *Arundinella*, *Trichopteryx*, *Loudetia*, and *Tristachya* from Hubbard's (1934) tribe the Arundinelleae. These data were fully discussed by de Wet (1954, 1956a and 1956b). The leaf anatomy may be either Panicoid or Festucoid, the chromosomes are medium large and in multiples of 6 and 7 (Avdulov, 1931, Calder, 1937, Stebbins and Love, 1941 and de Wet, 1954). The genera are mostly temperate in distribution with a few montane species extending to the tropics.

11. **Stipeae:** Is recognized in the sense of Hubbard (1934) to include the genus *Aristida*, except that *Melica* is removed. This tribe may be subdivided into two distinct groups which appear to have developed independantly. The one group includes *Aristida* and the other the remaining genera.

12. **Unioleae:** Pilger (1954) includes *Uniola*, *Distichlis*, *Monanthochloe*, *Vaseyochloa* and *Aeluropus* in various subtribes of the Festuceae. The genus *Jouvea* which also belongs here, Pilger refers to the tribe Jouveae of the Eragrostoideae. These genera from a natural group in having truncate lemmas with several parallel veins which often end in awns. They differ from members of the Festucoideae in leaf anatomy, cytology and spikelet morphology.

13. **Pappophoreae:** Besides the four genera placed by Hubbard (1934) in this tribe *Orcuttia* and *Neostapfia* are added. The epidermis is more or less Eragrostoid and the chromosomes are small in multiples of  $n = 10$ .

14, 15 and 16. **Lygeae, Nardeae and Micraireae:** These tribes consist of monotypic genera, all of which need further investigation. With the present evidence available they are difficult to place, but do not seem to be related to each other.

**RELIC GENERA:** A number of relic genera still remain to be discussed. These are *Schizachne*, *Melica*, *Pleuropogon*, *Glyceria*, *Fingerhutia* and *Coleanthus*. They are temperate in distribution and have vegetative characters resembling the true members of the Festuciformes. In the case of *Melica*, the chromosomes are as large as those of members belonging to the Festuciformes, but the basic chromosome number appears to be  $n = 9$  (Avdulov, 1931).

That they do not belong in the Festuciformes is quite evident. Their lodicules are truncate and often vasculated, their stigma branches are broad and dichotomous, their caryopses do not adhere to the palea and the embryo is relatively large. In *Glyceria* and *Pleuropogon* the chromosomes are medium large with basic numbers 9 and 8 respectively (Avdulov, 1931).

The chlorophyll distribution is of the Festucoid type in *Melica* and of the Festucoid type in *Glyceria* and *Pleuropogon*. In *Melica* the epidermis is also of the Panicoid type and of the Festucoid type in the latter two genera. In *Fingerhutia* the epidermis is either of the Festucoid or the Eragrostoid type. In *Coeleanthus* the leaf anatomy is typically Eragrostoid.

Morphological, cytological and anatomical data suggest an affinity with the Pappophoreae. It would appear, however, as if they originated from the primitive Arundineae stock, as did the Pappophoreae. These genera, although showing superficial resemblances to the Festuceae, are not closely related to them.

TABLE 1.—A tentative key to the classification of the Phragmitiformes.\*

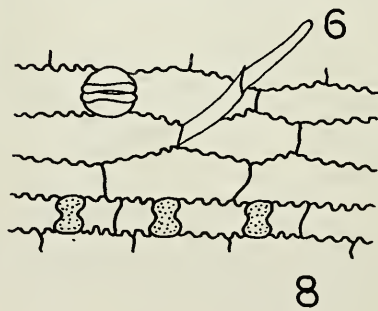
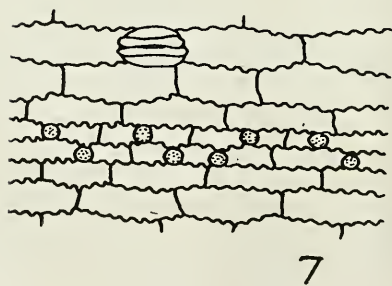
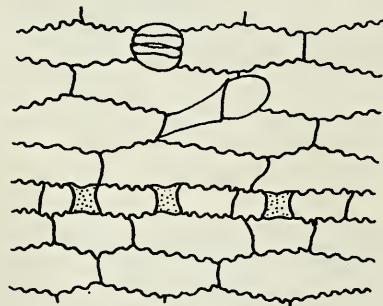
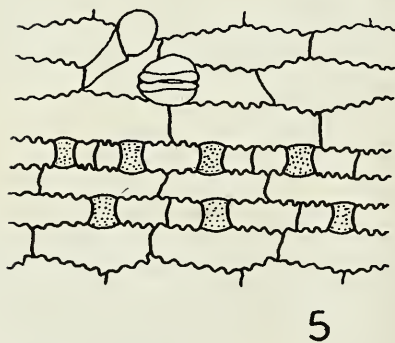
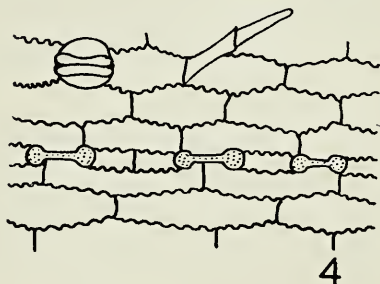
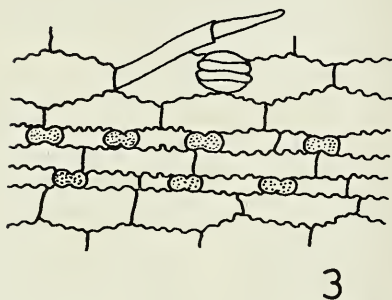
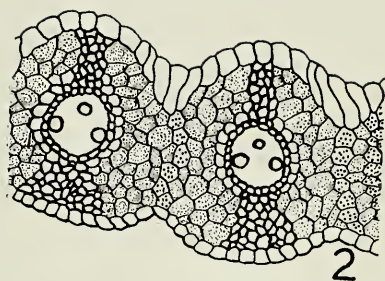
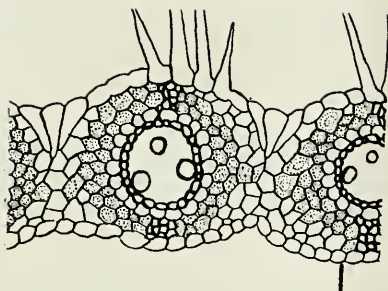
A. Leaves with cross veins; tropical. B. Palea split nearly to the base: Streptochaeteae. BB. Palea bilobed at the apex only. C. Plants arboreal: Bambuseae. CC. Plants not arboreal. D. Lodicules mostly 3; stigmas 3 or 2; spikelet with one functional flower. E. Stigmas 3; stamens 6: Phareae. EE. Stigmas 2; stamens 2 or 3: Olyreae. DD. Lodicules 2; stigmas 2; spikelet with more than one functional flower: Centotheceae. AA. Leaves without cross veins; tropical or temperate. F. Stamens 6 or more: Parianeae. G. Spikelets often enclosed in a sheath-like spathe. H. Stigma 1; stamens 4: Anomochloae. HH. Stigmas 2; stamens 6-4: Phyllo-rachiaeae, Oryzeae. FF. Stamens 3. GG. Spikelets not enclosed by a spathe. I. Stigmas 2. J. Lemmas with a single awn from the sinus between the lobes, awns reduced in some specialized groups. K. Spikelets with several florets: Arundineae. KK. Spikelets with a single functional floret; lemma indurated: Stipeae. JJ. Lemmas awnless or with several veins excurrent into awns. M. Lemmas awnless, laterally compressed: Uniolaee. MM. Lemmas with several parallel veins, which usually end in awns; rounded on the back: Pappophoreae. II. Stigma 1. N. Spikelet solitary, surrounded by a sheath-like spathe: Lygeae. NN. Spikelets in spikes: Nardeae.

## SUMMARY.

The leaf anatomy was investigated of a number of genera belonging to the series Phragmitiformes (Harz) Avdulov. Anatomical characters are found to be variable. Chlorophyll distribution is of the Panicoid or the Festucoid type. Epidermal traits may be of the Panicoid, Festucoid, Eragrostoid or Oryzoid type. The subfamilies Festucoideae, Oryzoideae, Olyroideae, Bambusoideae, Micrairoideae and Anomochloideae as recognized by Pilger (1954) are discussed. A number of genera and even whole tribes included by Pilger (1954) in the subfamily Festucoideae together with the other subfamilies are regarded as belonging to the series Phragmitiformes. Anatomical, cytological and morphological data support such a subdivision. The genera *Jouvea* and *Aristida* in the subfamily Eragrostoidae of Pilger are also transferred to the Phragmitiformes. The Phragmitiformes are classified and the affinities of the tribes pointed out. A key to the identification of these tribes is tentatively proposed.

It was pointed out that a miscellaneous group of grasses are lumped together in the Phragmitiformes. Most of these genera are more or less related to the true panicoids, true festucoids or the true eragrostoid-chloridoids. Others appear to be relic genera with no obvious affinities to these distinct groups of grasses.

\* A number of relic genera and the tribe Micraireae have been left out of this key.





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## LEGEND TO FIGURES.

FIGURES 1-2.—Semidiagrammatical drawings of leaf anatomy types,  $\times 500$ .

FIGURE 1.—Panicoid type.

FIGURE 2.—Festucoid type.

FIGURES 3-8.—Semidiagrammatical drawings of epidermal types,  $\times 500$ .

FIGURE 3.—Panicoid type; *Aristida barbicollis*.

FIGURE 4.—Panicoid type; *Aristida bipartita*.

FIGURE 5.—Eragrostoid type; *Aristida ciliata*.

FIGURE 6.—Eragrostoid type; *Fingerhutia sesleriaeformis*.

FIGURE 7.—Festucoid type; *Aristida gracilior*.

FIGURE 8.—Oryzoid type; *Olyra latifolia*.

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# Notes on the Loganiaceae, Salvadoraceae and Oleaceae in South Africa.

By

I. C. Verdoorn.

## 1. NOMINATION OF NEOTYPE FOR *STRYCHNOS DECUSSATA* (PAPPE) GILG.

When describing *Atherstonea decussata*, the basionym of the above species, Pappe wrote at the foot of the botanical description (see Silva Capensis ed. 2: 29, 1862)—“Grows in the thickets and forests of Uitenhage, Olifants Hoek and elsewhere in the districts of the Eastern Province”. In a footnote he wrote “named in honour of Dr. W. G. Atherstone, of Grahamstown, a gentleman whose merits rendered to South African Botany and Geology rank high, and to whom I am under great obligations for valuable information towards this work”. The type or types of this species would therefore be a specimen or specimens from the mentioned localities collected by Pappe or annotated by him as being *Atherstonea decussata*. To date no such specimens have been found and it is probable that no material was preserved. From the excellent description there is no mistaking what tree Pappe was describing so there can be no doubt that it is the same species that Harvey described and figured in his Thesaurus Capensis 2: 41 (1863) as *Strychnos atherstonei* with Dr. Pappe's name as a synonym. One of the specimens cited by Harvey is “On the Kowie, Dr. Atherstone”.

Through the kindness of Prof. D. A. Webb, Trinity College, Dublin, I was able to examine this specimen. According to the notes and labels on it, the sheet contains two gatherings, both by Dr. Atherstone from a tree on the Kowie in the Bathurst district. The flowering material, which is mounted on the lower half of the sheet (and spare material which is in an attached envelope), Dr. Atherstone states was picked by him in November 1863 from the same tree from which he had sent a fruiting specimen earlier in the year. (NOTE.—This is a year after the publication of Pappe's species and therefore cannot be the specimen on which he based *Atherstonea decussata*.) This fruiting specimen is mounted on the upper half of the sheet but the fruit is missing.

It is the flowering material that I wish to nominate as the neotype of the species. There is duplicate material of it in the Kew Herbarium and a scrap in the National Herbarium, Pretoria. Neotype of *Strychnos decussata* (Pappe) Gilg.: Cape, Kowie, *Atherstone* s.n., flowering material, (TCD, neo.!; K, PRE, iso-neo).

## 2. THE RELATIONSHIP BETWEEN *STRYCHNOS INNOCUA* DEL., *S. DYSOPHYLLA* BENTH. AND *S. GERRARDII* N.E.BR.

In the Kew Bulletin 1938, page 46 Bullock and Bruce reduced *Strychnos dysophylla* Benth., together with a number of other described species and varieties, to synonymy of *S. innocua* Del. In 1956, after studying the tropical African specimens involved, Miss E. A. Bruce decided to exclude *S. dysophylla* Benth. (and three species which she regarded as being synonymous with *S. dysophylla*) from that long list of synonyms and again treat it as a separate species. Her views were published posthumously in the Kew Bulletin of that year on page 270 under notes by Bruce & Lewis. The main reason given is that it is “undesirable to conceal the variation” in this group.

A study of the South African material both in herbaria and in the wild leads to the conclusion that the broader view of *S. innocua* Del. can be more satisfactorily applied to the whole complex. If *S. dysophylla* Benth., with its southern distribution, is restored to specific rank the following are some of the difficulties that are encountered.

i. Specimens in the southern regions, prepared from different parts of the same tree or in different seasons, could be identified from the key, some as *S. innocua* and some as *S. dysophylla*.

ii. It is very difficult to decide to which of these two species the taxon which was described as *S. gerrardii* N.E.Br., and which occurs in Natal, is the more closely related, in other words, of which is it a subspecies or variety since it obviously belongs to the same complex and should not have specific status.

In connection with the first difficulty, *S. dysophylla* as defined by Bruce and Lewis differs generally from *S. innocua* ssp. *innocua*, of which, to date, there is no authentic record from southern Africa, in the following features: the branchlets usually smooth and dark, either brown or grey, instead of pale and farinose; contracted lateral branchlets present; lenticels conspicuous, leaves on the whole smaller, seldom over 7 cm long as against up to 15 cm long, and drying a dark colour; the inflorescence sessile instead of shortly pedunculate and the flowers only about 5 mm long instead of about 10 mm long. But there are exceptions and one or more characteristics of the tropical specimens may be found among specimens which, from the locality, or because of some other features, belong best to *S. dysophylla*. These exceptions seem to indicate that the differences are merely subspecific, that certain features have become accentuated on plants in the one region and another set in the other, so that, on general appearance, the specimens can, roughly, be separated into groups.

With regard to the second difficulty, *S. gerrardii* N. E. Brown differs from *S. innocua* ssp. *innocua* principally in the comparatively slender branchlets which are not fairnosed, the conspicuous lenticels and the narrower leaves and it agrees with this taxon in the normally developed branchlets and the peduncled inflorescences. These latter features seem more important taxonomically and they are the features in which it differs from *S. dysophylla*. Therefore it would seem to be more closely related to *S. innocua*. Yet Bruce and Lewis suggest (Kew Bull. 1956: 275) that *S. gerrardii* may be synonymous with *S. dysophylla* ssp. *engleri* (Gilg) Bruce and Lewis, giving it a closer relationship with *S. dysophylla*.

These difficulties are overcome if *S. dysophylla* and *S. gerrardii* are included in the compound species, *S. innocua*, and given subspecific status, the same rank as *S. innocua* subsp. *burtonii* (Bak.) Bruce and Lewis and *S. dysophylla* subsp. *engleri* (Gilg) Bruce and Lewis but under one species. This does not conceal the variation in the complex species and the objection expressed by Bruce and Lewis will be overcome.

New combinations will be necessary in this arrangement and are made below:—

*S. innocua* Del. subsp. *dysophylla* (Benth.) Verdoorn.

*S. dysophylla* Benth. in Journ. Linn. Soc. 1: 103 (1857).

Type: Delagoa, *Forbes* s.n.

*S. innocua* Del. subsp. *gerrardii* (N.E.Br.) Verdoorn.

*S. gerrardii* N.E.Br. in Kew Bull. 1896: 162 (1896).

Type: *Medley Wood* 5624 (K, lecto, PRE fragment lecto!).

I nominate *Medley Wood* 5624, the sheet in the Kew Herbarium seen by Brown and of which there is a portion in the National Herbarium, Pretoria, as the lectotype of *Strychnos gerrardii* N.E.Br., selected from the following syntypes: *Berea*, *Medley Wood* 5624; Cult. *Medley Wood* 1777; without locality *Gerrard* 1421.



### 3. SINKING THE GENUS *CHILIANTHUS* UNDER *BUDDLEIA*.

The three genera *Nuxia*, *Chilianthus* and *Buddleia* as defined in the *Flora Capensis* (Vol. 4, 1: 1037) are obviously closely related and *Chilianthus* is the link between the other two genera which, by themselves, would be easily distinguishable. Being the intermediate group it is not surprising to find that its members have at different times been classified under either *Nuxia* or *Buddleia*.

Bentham classified all 4 known species of *Chilianthus* as *Nuxia* species (see Comp. Bot. Mag. 2: 60, 1836) and from Burchell's unpublished notes on his specimens it can be seen that he identified the two *Nuxia* species he collected, *N. floribunda* Bth. and *N. congesta* R.Br. ex Fres., as "*Chilianthus*". When describing the new genus *Chilianthus* (see Travels 1: 94 (1822), Burchell contrasted it only with *Scoparia* and did not mention *Nuxia* or *Buddleia*.

The view that *Nuxia* and *Chilianthus* are congeneric can hardly be justified, for although in general appearance the flowers in both genera are similar, having the corolla tube short and the stamens exserted, yet in the leaves, general habit and certain other details they are markedly dissimilar. For instance in *Nuxia* the anther-cells are confluent, the corolla circumscissile near the base, and there are no stipules present, whereas in *Chilianthus* the anther-cells are distinct, the corolla not circumscissile and there are stipules, or at least interpetiolar ridges, present.

The view, on the other hand, that *Chilianthus* and *Buddleia* are conspecific has proved on investigation, to be feasible.

In 1946, E. P. Phillips reduced the genus *Chilianthus* to a synonym of *Buddleia* (see Journ. of S.A. Bot. 12: 113). When doing so he showed that in the last analysis the only character by which these two genera could be separated is the exserted stamens of *Chilianthus* as against stamens included in *Buddleia*, and then, he continues, that in one known *Chilianthus*, *C. corrugatus*, "the anthers are very little exserted". He points out too that in most of the known classifications, such as *Genera Plantarum* and *Pflanzenfamilien*, the close relationship of *Chilianthus* and *Buddleia* is emphasized.

On first thoughts one may be inclined to wonder why *Chilianthus* and *Buddleia* should not remain distinct since in South Africa the two groups are easily distinguished, for all our known species of *Buddleia* have flowers with a tubular corolla and stamens included while the *Chilianthus* species have short campanulate corolla-tubes and at least the anthers exserted. But a study of the whole genus *Buddleia* reveals that the representatives in Africa are not typical of the genus as represented in America and, as Dr. Phillips also pointed out, differ almost as much from the type species, *B. americana*, as they do from the species placed in *Chilianthus* in S. Africa. From this it is obvious that the two groups of species in South Africa can at most be treated as two sections of the genus *Buddleia*.

### 4. REASONS FOR AGAIN REDUCING THE GENUS *LACHNOPYLIS* TO *NUXIA*.

In the Kew Bulletin, 1930 C. A. Smith resuscitated *Lachnopylis* Hochst. which Bentham had reduced to *Nuxia* Lam. giving his reasons for considering it generically distinct from this monotypic genus. These reasons have never seemed very convincing.

In several publications on the tropical African flora, Smith was followed, for example by Robyns in the *Flora of the Parc National Albert*, Vol. 2: 59 (1947), and Brenan and Greenway in *Check-List of the Forest trees and Shrubs of the British Empire* No. 5, 2: 270 (1949). On the other hand, when dealing with the specimens in the Mascarene Islands, that is in the region where both genera occur, *Nuxia* on Mauritius and Reunion and *Lachnopylis* on Madagascar and the Comoro Islands, Paul Jovet retains the name *Nuxia* for all the species and treats *Lachnopylis* as a sub-genus of *Nuxia* (see for instance *Notulae Systematicae* 13: 97 (1947)).

Further, the systematists at present working on the *Loganiaceae* for the "Flora of Trop. East Africa" have independently come to the decision that *Lachnopylis* is not generically distinct from *Nuxia* and so all the tropical African species are to be placed in the genus *Nuxia* in that work.

With these two supporting opinions, and for the sake of uniformity in Africa it has been decided to re-instate *Nuxia* in the South African Flora as well.

The taxonomic reasons for favouring this treatment are that the points of similarity between *Nuxia verticillata*, the type species of the genus, and the species in the Mascarenes and Africa which Smith would refer to *Lachnopylis*, seems to be of more significance as generic characters than are the differences.

The similar features are: ternate leaves; inflorescence of compound cymes; a tubular calyx with erect lobes and lined with appressed hairs; the corolla circumscissily deciduous from near the base; and the anther-cells confluent. A combination of some or all of these features are convincing as generic characters. The most important differences are that *Nuxia verticillata* has the corolla-tube longer than the calyx with the style included in the corolla-tube as against the calyx being longer than the corolla-tube in all the other species with the style exerted from both calyx and corolla.

These are hardly generic differences especially since the general appearance of the flower is the same in both groups, the corolla-lobes reflexing in *N. verticillata* exactly as in the others, although the calyx does not reach to the point where they reflex; and if one takes the relationship of the style to the persistent calyx instead of to the deciduous corolla it is longer than the calyx in both groups. These differences seem no more than specific but might be regarded as worthy of some higher (sub-generic) ranking if all the species, including those in the Mascarenes, are studied.

Under the present treatment the following combination is necessary:—

*Nuxia glomerulata* (C.A.Sm.) Verdoorn for *Lachnopylis glomerulata* C. A. Smith in Kew Bull. 1930: 24 (1930).

Although C. A. Smith described 8 new species under *Lachnopylis* in the above mentioned publication it has been found, now that the genus is better known in the wild, that only this one (*L. glomerulata*) can be maintained as a species. Of the other seven, one, *L. suaveolens* C.A.Sm., is a synonym of *L. glomerulata* and the rest have been reduced under the very variable and widespread, but characteristic, species *Nuxia congesta* Fres.

This wide view of *N. congesta* conforms to that of the workers on the Flora of Tropical East Africa.

##### 5. NEW STATUS FOR *SALVADORA AUSTRALIS* SCHWEICKERDT.

Comparison of the specimens of *Salvadora australis* Schweickerdt (Bothalia 3, 3: 248, 1938) with the description and figure of the Madagascar species *S. angustifolia* Turrill (Kew Bull., 1918 and Flora Madagascar, 1946), shows a great similarity especially in features such as the shape and spread of the leaves and the presence of well developed glands between the filaments. These are the very features which characterize *S. australis* and distinguish it from *S. persica* L. Through the kindness of Dr. Renaud Paulian I was able to examine two specimens of *S. angustifolia* from Madagascar which he sent on loan to the National Herbarium, Pretoria. This confirmed the similarity between the specimens from the two countries and the only evident difference noted was the persistent, short, dense pubescence on the South African specimens as compared with the glabrous or partly scaly specimens from Madagascar.

Pubescence in this family is not usually of specific significance and, in most cases, does not warrant even subspecific distinction, but the nature of the pubescence and the remoteness of the areas of distribution seem, in the case under consideration, to justify varietal separation. The following combination is therefore made:—

***Salvadora angustifolia* Turrrill var *australis* (Schweick.) Verdoorn stat. nov. *S. australis* Schweick. in *Bothalia* 3, 3: 248 (1938).**

#### 6. LECTOTYPE OF *JASMINUM BREVIFLORUM* HARV. EX WRIGHT.

In the revision of the Oleaceae, *Bothalia* 6: 549 (1956), I wrote in the introduction on page 549, concerning the authorship of certain species, that, in my opinion, Harvey should get the credit for them rather than the publishing author. I felt that since Harvey supplied the descriptions these were parallel cases to those cited under Recommendation 46B of the 1956 Code of Botanical Nomenclature. While I still abide by my decision in the case of *Menodora juncea* which was published post humously in Harvey's *Genera Plantarum* ed. 2, 1869, I now feel that in connection with *Jasminum breviflorum*, *J. Gerrardii* and *Olea enervis*, it is more correct to cite the authority as "Harv. ex Wright" and therefore if abbreviating "Wright" should be cited.

My reasons are: (1) That "in Wright in *Flora Capensis*" may not be what is intended by "in a work by another author (see Rec. 46B)". (2) I have no proof that Wright did not change Harvey's descriptions to some extent; (3) at least in one case Wright cites a specimen that Harvey could not have seen; and (4) if Harvey is cited as author there is uncertainty about the holotypes.

The reviewed treatment, that is citing the author in these cases as "Harv. ex Wright", requires the selection of a type for *J. breviflorum* since Wright cited 2 specimens. I here select the sheet in the Kew Herbarium of Burke from the Magaliesberg which has on it a label reading "seen by Dr. W. H. Harvey" and written to the left of this label the word "type".





# Notes on the Genus *Royena* in South Africa.

By

B. de Winter.

During a study of the accumulated material of this genus in the National Herbarium, Pretoria and in the Kew Herbarium, London, it became evident that the treatment and delimitation of the species in the *Flora Capensis* 4 (1906) was no longer satisfactory. The following notes are the result of a study of plants in the field and also of the ample herbarium material available for study.

The most important characters in distinguishing species are in the fruits and mature leaves, and fruiting specimens are therefore best suited for identification. In contrast to those of many other groups, the floral parts of *Royena* are variable within the species especially in size, and show hardly any characters of diagnostic value on the specific level. The distribution of the species was found to be a very useful aid in confirming the identification of incomplete or very young specimens.

A wider concept of species has simplified identification and what is more important, has, in my opinion, presented a truer picture of the relationship of the various taxa to each other.

The discussion of the sex of the flowers of *R. glabra* in *Journ. S. Afr. Bot.*, April, 1953 by Salter has been corroborated by the study of other species in the field as well as in the herbarium. All the species have proved to be dioecious, with functionally male flowers, and female flowers with staminodes borne on different plants. The female plants, which are in the minority in all the populations studied in the field, and also in material in herbaria, never have pollen and are therefore truly female. The functionally male plants are apparently hermaphrodite since they very often have fairly well developed ovaries which, however, normally do not ripen into fruits and soon abort. Fruits have been noticed occasionally on male plants and have proved to have some apparently fertile seeds. It seems best therefore to refer to the species as subdioecious as has been done by other authors.

The treatment of the genus in the *Flora Capensis* lists 17 species. This number has now been reduced to 13.

A full account with keys and descriptions will be published in the forthcoming *Flora of Southern Africa*.

## NEW COMBINATIONS AND VARIETIES.

***Royena cordata* E. Mey. ex DC. var. *scabrida* (Harv. ex Hiern) de Winter comb. nov.**  
 Basionym. *R. scabrida* Harv. ex Hiern in *Trans. Cambr. Phil. Soc.* 12, 82 (1872).

***Royena lycioides* (Desf.) A. DC.**

(a) subsp. ***sericea* (Bernh. ex Krauss) de Winter comb. nov.**

Basionym. *R. sericea* Bernh. ex Krauss in *Flora* 27, 824 (1844).

(b) subsp. ***guerkei* (O. Ktze.) de Winter comb. nov.**

Basionym. *R. guerkei* O. Ktze. *Rev. Gen. Pl.* 3, 2, 196 (1898).

(c) subsp. *nitens* (Harv. ex Hiern) *de Winter* comb. nov.

Basionym. *R. nitens* Harv. ex Hiern in Trans. Cambr. Phil. Soc. 12, 87 (1873).

### *Royena hirsuta* L.

(a) var. *microphylla* (Burch.) *de Winter* comb. nov.

Basionym. *R. microphylla* Burch. Trav. 1, 348 (1822).

(b) var. *rubriflora de Winter* var. nova var. *microphyllae* et var. *hirsutae* affinis, a var. *microphylla* foliis maioribus differens, ab ambabus floribus coccineis, nec roseis modo var. *microphyllae* nec *cremeis* modo var. *hirsutae*.

Type: Natal. Mont aux Sources, lower slopes of Drakensberg, flowers port-wine red. Aug., 1930, Hutchinson, Forbes and Verdoorn No. 4 (PRE, holo) = Hutchinson 4483 in K.

### *Royena villosa* L.

var. *parvifolia de Winter* var. nov., var. *villosae* affinis foliis minoribus minus 3-5 cm longis, fructibus minoribus differt.

Type: Transvaal, Soutpansberg: Elim, plants supported by other trees, Obermeyer 713. (Tvl. Mus. No. 28377 in PRE, holo).

The distribution of this variety is limited to the Northern and North-eastern Transvaal.

## A NEW SPECIES OF ROYENA.

*Royena acocksii*, species nova affinis *R. ramulosae* sed ita differt: folia multo maiora subtus sparsissime strigosa ramuli subglabri rubri-brunnei, flores semper tetrameri corolla calyci subaequali vel quam calycem paululum maiore.

Rigidly branched shrubs up to 15 ft. high. *Branches* straight, spreading at nearly right angles, bark smooth to finely rugose, ashgrey with blackish markings to grey with a reddish brown tinge; young branches smooth, deep mahogany red, glabrous or with a few scattered adpressed hairs. *Leaves* alternate, very shortly but distinctly petiolate, 1.0 cm to 2.0 cm long and 0.5 cm to 1.0 cm broad, elliptic to obovate-elliptic, glossy, coriaceous, finely rugose and glabrous above, more or less smooth and sparsely strigose below (young leaves densely strigose); margins usually slightly undulate, entire, often involute; nerves inconspicuous except for the midrib and sometimes faintly marked secondary nerves. *Flowers* tetramerous, solitary in the axils of the leaves, functionally male (apparently hermaphrodite) or female with the stamens reduced to staminodes, pendulous, up to 1 cm long but mostly shorter, peduncles 0.5 cm to 0.7 cm long, sparsely strigose; bracts 2, more or less approximate, up to 0.5 cm long, oblanceolate. *Calyx* deeply divided, lobes 4, triangular, 0.4-0.5 cm long and 2.5 mm wide at the base, sparsely strigose outside, glabrous inside, rather thick in texture. *Corolla* creamy white, urceolate, four-angled, slightly hairy on the angles, otherwise glabrous; tube short ( $\frac{1}{4}$  length of flower); lobes very broadly ovate with an acute apex, distinctly imbricate. *Stamens* 8, 3.0 mm long, filaments very short and broad, glabrous; anthers lanceolate, 2.5 mm long, hairy on the back, less so on the inside face, dehiscing by longitudinal slits. *Ovary* borne on a distinct disc, four-angled, pyramidal, when more mature very broadly oblong, glabrous, or sparsely hairy on the angles; style as long as the four branches or slightly shorter. *Fruits* 1.0-1.3 cm long, glabrous, broadly oblong to semi-globose, slightly 4-angled, occasionally dehiscing along the four sutures which are visible as four fine but distinct lines. *Calyx* accrescent,  $\frac{1}{4}$  the length of the fruits, lobes ovate, apices acute, more or less reflexed. *Seeds* strongly laterally compressed, 8 (or fewer), glabrous blackish, shiny.

CAPE PROVINCE.—Little Bushmanland; (Pella) near dry stream bed, bush 12–15 ft. high, *Pearson* 3546 (K). Kenhardt: Five miles north of Pofadder in the “Orange River Broken Veldt” of rocky hills, shrub up to 10 ft. high alt. 3,300 ft., *Acocks* 14395 (PRE holo; Isotype in K.); 126 miles from Kenhardt, *Pole Evans* 2259 (PRE).

SOUTH WEST AFRICA.—Warmbad district: beside streamlet (dry watercourse!) on farm Witzand, *Galpin* 14149 (K, PRE); 20 miles from Warmbad on Goodhouse road, shrub, 6 ft. high *Galpin* s.n. (K, PRE).

*R. acocksii* is a very distinct species with tetramerous flowers and relatively small, leathery, inconspicuously nerved leaves with undulate margins. It can be distinguished easily from the tropical spp. of *Royena* with tetramerous flowers by the much smaller subglabrous leaves. Two of the South African species can have tetramerous flowers, one of which, *R. glandulosa*, shows very little resemblance to *R. acocksii*. In *R. glandulosa* the calyx lobes are much accrescent and exceed the fruits in length, and the young parts are covered with glands. The second species, *R. ramulosa*, only occasionally has tetramerous flowers but there is a certain similarity in the leaves and fruits which suggests an affinity with *R. acocksii*. Their climatic requirements are also similar, but *R. acocksii*, is confined to the arid areas near the Orange River in the northern Cape Province and north of the river in South West Africa, while *R. ramulosa* has a wider distribution.

#### THE LECTOTYPE OF *R. PALLENS* THUNBERG.

*R. pallens* Thunberg Prodr. 80 (1794).

Syn. *R. brachiata* E. Mey. ex DC. Prodr. 8, 213 (1844).

In the Flora Capensis Hiern took a very broad view of this species, including as synonyms, amongst others, *R. pubescens*, *R. lycioides* and *R. sericea*. Of these I regard the first two as distinct and the latter as a subspecies of *R. lycioides*. The other synonyms given by Hiern are referable to one or other of the three species. There are fruit and leaf characters distinguishing these two species and their distributions are also fairly well defined. At least part of the confusion which existed in *R. pallens* can be attributed to the fact that four different plants are present on the three sheets in Thunberg's herbarium. Sheet 1 consists of two twigs of the species referred to by E. Meyer and published by DC. as *R. brachiata*. Sheet 2 consists of three twigs of *R. pubescens* Willd. and a loose fruit of *R. lucida*. The short description “*R. foliis oblongis obtusis glabris margine revolutis*” could equally well be applied to sheet 1 and to the specimens of *R. pubescens* on sheet 2. Sheet 3 consists of a rather atypical twig of *R. pubescens* and a twig of *Rhoicissus cirrhiflorus* (L.f.) Gilg. & Ben. and is therefore excluded as a possible lectotype. Since sheet 1 and 2 are equally eligible for selection as the lectotype on other grounds, the lectotype should be selected “so as to preserve current usage” App. 1d. of the ‘Rules’ (1952).

By choosing sheet 1 as the lectotype of *R. pallens* it is possible to retain the name *R. pubescens* Willd. in its currently accepted sense. If on the other hand sheet 2 is chosen, *R. pubescens* becomes a synonym of *R. pallens* and the species on sheet 1 will have to be referred to as *R. brachiata*—a name which has not been in current use since its inception.

Sheet 1 is therefore chosen as lectotype and the name *R. pallens* becomes restricted to a rather localised species so far recorded only from the Knysna, Port Elizabeth, Uitenhage and Bathurst districts.





# New and Interesting Records of African Flowering Plants.

By

Various Authors.

## ASCLEPIADACEAE.

*Ceropegia occulta* R. A. Dyer sp. nov., affinis *C. caffrorum* Schl. habitu crassiore, alabastro obtusiore, corollae lobis latioribus coronae lobis interioribus oblongo-ellipticis obtusis differt.

Herba perennis simplex vel sparse ramosa. *Tuber* 1·5–4 cm diam. *Rami* ad 20 cm longi, procumbentes vel suberecti nonnunquam volubiles, 2 mm crassi. *Folia* sessilia vel brevissime petiolata, carnosa, late ovata-vel lineari-lanceolata, 1–2 cm longa, 3–10 mm lata, acuta. *Flores* 1–2 extra folii axillam exorti, erecti, pedicillis 1 cm longis. *Sepala* lineari-lanceolata, 3–3·5 mm longa. *Corolla* 2–2·8 cm longa, apice obtusa; tubus 1·5–2 cm longus, basi ovoideo-inflatus, plus minusve 5 mm diam., in media parte 2·5–3 mm diam. in faucibus 5·6 mm extra et intus glaber; lobi 6–7 mm longi, apice per 2 mm connati, basi et apice 3·5 mm lati, medio 2·5 mm lati, intus breviter pubescentes, carinati. *Coronae exterioris lobi* poculiformes; 0·5 mm lati cum lobis interioribus connati; coronae interioris lobi incumbenti-erecti, 2·5 mm longi, oblongo-elliptici, obtusi, subcarnosi.

### PLATE I.

CAPE PROVINCE.—Worcester Division; near Tweefontein, foothills under bushes, *Van Breda* 85 (PRE, type); *Erens* and *van Breda* 2264 (photograph).

Plants forming one to several subglobes tubers 1·5–4 cm in diam. with a few fibrous roots. *Stems* 1–4 from each main tuber, up to about 20 cm long, rarely showing signs of twining, 2 mm thick; lower internodes 2–6 cm long, towards apex of branches reduced to about 1 cm long or less. *Leaves* sessile or subsessile very variable in shape, the broadest towards the base ranging from nearly circular to ovate to linear-lanceolate. 1–2 cm long, 3–10 cm broad, fleshy, grooved down face, convex on lower surface, acute. *Cymes* laterally produced at nodes, subsessile, 1–2-flowered; flowers produced successively, sometimes the second aborted; pedicels up to about 1 cm long, glabrous. *Sepals* linear-lanceolate, 3–3·5 mm long. *Corolla* 2–2·8 cm long, very slightly curved or straight with tube 1·5–2 cm long, inflated at base to about 5 mm diam. 2·5–3 mm diam. above and spreading at the mouth to 5–6 mm; glabrous inside and outside, finely longitudinally ribbed within the inflation; lobed portion in bud 5–8 mm long with a slight constriction about the middle and a flattened united apical portion, apiculate; lobes about 3·5 mm broad at base and the same towards apex, 2·5 mm at middle, united for 2 mm at apex forming cap about 4 mm wide, apiculate in middle, each lobe shortly hairy within the margin and keeled down the inner face with the keel broadened to 1·5 mm at the base; margins only slightly replicate leaving comparatively small apertures between the lobes. *Corona* appearing as one series; outer corona of small spreading pockets about 0·5 mm wide, confluent with the base of inner lobes; inner lobes incumbent-erect, narrowly oblong-elliptic, 2·5 mm long, obtuse, somewhat fleshy. *Pollinia* subglobose, about 0·25 mm diam. with narrow amber-coloured inner margin which extends into a minute apical point (a feature not observed previously).

It is remarkable that this species of *Ceropegia*, which grows closest to the first port of entrance to the Union at Cape Town, should be among the last to be named specifically. No earlier record of the species seems to exist than a collection by P. A. B. van Breda shortly before 1950. He found it well hidden—hence the name—under the protection of karoo shrublets near Tweefontein in the Worcester district. In 1950 he and Mr. J. Erens, then head gardener of the Division of Botany, gathered more material at the same site for cultivation in Pretoria. This material flowered in September of the same year and although it was photographed, no herbarium specimen appears to have been preserved at the time.

In June, 1956, Mr. van Breda made further collections on request. A few flowers were present at the time and the holotype consists of this material, and duplicates were made when the plants continued to bloom at the Division of Botany, Pretoria, during February, March and April of 1957. Although the species appears to have a fairly long flowering period, it grows slowly and is not very floriferous. Under natural conditions the stems are relatively short and rarely show signs of twining, whereas under cultivation the stems are more robust and twine when placed on a support.

It seems that *C. occulta* is nearest in affinity to *C. caffrorum* Schl. and its allies in the eastern Cape Province near Uitenhage. It differs from these in the shape of the corolla lobes and the obtuse cage-like structure they form, and also in the more fleshy obtuse inner corona lobes. The pollinia are specially interesting. It is readily distinguished from *C. africana* R. Br., figured in the Botanical Register 626 (1822), and since recorded from near Oudtshoorn, by the falcate inner corona lobes of the latter.

R. A. DYER.

#### CALLITRICHACEAE.

*Callitriche bolusii* Schonl. et Pax ex Marl., Flora S. Afr. II, ii: 141 (1925).

The valid publication of this name seems so far to have been overlooked. It was first rendered as *Callitriche bolusiana* Schonl. et Pax in a note in Engl. Pflanzenw. Afr. III, ii: 169 (1921), but in Marloth's Flora under *C. bolusii* there is a series of line drawings which make it possible to identify the plant without doubt. Contrary to Marloth's observations the plant is restricted to the eastern Cape Province and has not been found in the Transvaal.

MAYDA HENDERSON.

#### COMPOSITAE.

*Helichrysum albirosulatum* Killick, sp. nov., affine *H. flanaganii* Bolus, sed habitu robustiore, foliis argenteo-albis, floribus majoribus paucioribus differt.

*Fruticulus* prostratus, ad 6 cm altus, omnino indumento argenteo-albo vestitus. *Folia* rosulata, plerumque spatulata interdum obovata, 1.4–2.2 cm longa, 5–6 mm lata, apice acuta vel obtusa plus minusve uncinata, basi attenuata. *Pedunculi* suberecti, 8 cm longi, foliati. *Corymbi* polycephali, semi-globosi, 1.3–1.5 cm diam. *Capitula* 5 mm longa, 2.5–3 mm lata. *Involucri bracteae* 3-seriatae, erectae, aureo-flavae, ab exteriore gradatim majores. *Flores* hermaphroditi, 10–12, aureo-flavi; corolla tubulosa, supra ampliata. *Achaenia* papillosa, breviter pubescentia.

NATAL.—Underberg District: rocky slopes of Bamboo Mountain, McLean 697. Estcourt District: top of Little Berg, 6,000 feet, Cathkin Park, Galpin 11838. Bergville District: Cave Sandstone outcrops, 5,500 feet, Cathedral Peak Forest Influences Research Station, Killick 1919 (PRE, type).

A prostrate, much-branched shrublet, up to 6 cm high, covered all over with a silvery-white, somewhat glossy, very closely felted indumentum. *Leaves* rosulate, spatulate or sometimes obovate, 1.2–2.2 cm long, 4–6 mm wide, apex acute or rounded, somewhat hooked, base attenuate. *Peduncles* suberect, 6–12 cm long, leafy. *Corymbs* many-headed, semi-globose, 1.3–2 cm diam., densely araneous underneath. *Capitula* 5 mm long, 2.5–3 mm wide. *Involucral* bracts in 3 rows, erect, golden-yellow at the tips; outer broadly elliptic, 4.5 mm long, 2 mm wide, subtended by a single large obovate bract 5 mm long, 2.5 mm wide; median ovate, 4 mm long, 2 mm wide; inner linear-lanceolate, 3.5 mm long, 1 mm wide, apex reflexed. *Florets* hermaphrodite, 10–12, golden-yellow; corolla tubular, widening above; pappus of numerous bristles successively shorter towards base; anthers with an acute appendage at apex, acuminate tails at base; style branches truncate. *Achenes* papillose and shortly pubescent.

*Helichrysum albirosulatum* seems to be restricted to Cave Sandstone outcrops in the Drakensberg area. Usually it is found on the “pavements” situated along the edge of the “Little Berg,” the terrace immediately below the main escarpment. This species with its numerous silvery-white rosettes forms extensive mats, which are a conspicuous feature of Cave Sandstone Macchia with *Passerina montana*, *Protea roupelliae* and *Erica* spp. as dominants. The known distribution of *Helichrysum albirosulatum* is between Bamboo Mountain, Underberg, in the south, and Cathedral Peak in the north. It was first collected by E. E. Galpin in March, 1932.

It differs from its nearest ally, *H. flanaganii* Bolus, in that the plant is more robust, the indumentum silvery-white and somewhat glossy instead of dull grey and in having florets which are larger and fewer per head (10–12 instead of 30 or more).

***Helichrysum drakensbergense*** Killick, sp. nova, distinctissima, nullis e specibus notibus propinqua.

*Herba* decumbens, ad 35 cm alta, omnino cano lanata. *Folia* spatulata, 3.5–4 cm longa, 1.2–1.8 cm lata, apice subacuta vel rotundata, basi multo attenuata. *Pedunculi* ascendentes, 15–18 cm longi. *Corymbi* plani, 2–2.4 cm diam., infra dense araneosi. *Capitula* congesta, subcampanulata, 6 mm longa, 3.5–4 mm lata. *Receptaculum* conicum, nudum. *Flores* hermaphroditi, circiter 27. *Involucri bracteae* plerumque 3-seriatae, flavae, nitidae. *Corolla* pallide lutea. *Pappi setae* numerosae, plumosae. *Achaenia* breviter pubescentia.

NATAL.—Bergville District: frequent in alpine grassveld below Organ Pipes Pass, 9,200 feet, Cathedral Peak Forest Influences Research Station, Killick 1879 (PRE, type).

A decumbent to suberect herb up to 35 cm high, grey-lanate all over. *Leaves* spatulate, 3–5 cm long, 1.2–2.2 cm wide; apex subacute or round; base much attenuate appearing almost petiolate, somewhat stem-clasping. *Peduncles* ascending, up to 22 cm long, with single clasping lanceolate bract 2.2 cm long. *Corymbs* flat-topped, many-headed, 2–3 cm diam., densely araneous underneath. *Capitula* congested, subcampanulate, 6 mm long, 3.5–4 mm wide at summit. *Receptacle* conical, nude. *Florets* hermaphrodite, about 27. *Involucral* bracts usually 3-seriate, imbricate, not radiating, straw-coloured, glossy; outer linear or lanceolate, 4–5 mm long, embedded in wool; median lanceolate to spatulate, 5 mm long, 1.2–1.5 mm wide; inner similar to median. *Corolla* pale yellow; tube narrowly cylindrical, 4 mm long, widening slightly in upper third then abruptly at summit; lobes deltoid, 0.5 mm long, 0.3 mm wide at base; anthers with appendage at apex and acuminate tails at base; style branches truncate. *Pappus* of numerous plumose bristles with the trichomes progressively shorter towards the base. *Achenes* 5-ribbed, minutely pubescent.

*H. drakensbergense* is a very distinct species without any obviously close ally, consequently its position in the genus is difficult to establish. When one uses Harvey's key in *Flora Capensis* it runs to the section *Stoechadina*, but its relationship to the constituent species of that section is obscure.



It is surprising that this quite conspicuous plant has not been recorded before. It grows in alpine grassveld below the Organ Pipes Pass next to a footpath which is frequently used by climbers making for Cleft Peak or Basutoland and is a socially growing species forming fairly large communities.

**Senecio cryptolanatus** Killick, sp. nov., affinis *S. tugelensis* Wood et Evans, sed plantis acaulescentibus differt.

*Herba* acaulescens, ad 8 cm alta, rhizomate lanato robusto. *Folia* rosulata, spatulata, 5–7 cm longa, 1–1.4 cm lata, apice subacuta vel obtusa, plus minusve carnosa, glabra, nervis immersis, marginibus integris rubris, in axillis lanata. *Pedunculi* simplices, 17 cm longi, bracteis 8. *Capitula* solitaria, subcampanulata, 1 cm longa, 1.3–1.5 cm lata, calyculata. *Involucri bracteae* circiter 20, lineari-lanceolatae, 7–8 mm longae, 1.5 mm latae. *Receptaculum* alveolatum. *Flores radii* circiter 17, lutei. *Flores disci* numerosi. *Pappi setae* numerosae, barbellatae. *Achenia* glabra.

CAPE.—Barkly East District: Doodman's Krans Mountain, Drakensberg, 8,900 feet, Galpin 6723 (in part).

NATAL.—Bergville District: top of Mont aux Sources, 11,000 feet, Evans 743 (in part); mountain top, 11,000 feet, Mont aux Sources, Allsopp 24; very rare on streambank on summit of Drakensberg between Indumeni Dome and Cleft Peak, 9,700 feet, Killick 1941 (PRE, type).

NOTE.—Evans 743 and Galpin 6723 in the National Herbarium are mixtures consisting of *Senecio cryptolanatus* and *S. tugelensis*. Mr. W. Marais, our liaison officer at Kew, reports that Evans 743 in Herb. Kew. has the same mixture, but that Galpin 6723 is *S. tugelensis* only. He also reports that Milford 636 and Galpin 6722 are *S. cryptolanatus*.

An acaulescent herb up to 8 cm high with a thick and woolly rootstock. *Leaves* rosulate, spatulate, occasionally oblanceolate, 3–8 cm long, 0.5–1.7 cm wide, apex subacute to obtuse, somewhat fleshy, glabrous, veins immersed, margins red, usually entire but sometimes distantly serrate, axils with long tufts of white wool. *Peduncles* simple, rarely divided into two; bracts 5–10, lanceolate with a subrotund base, white wool in axils. *Heads* solitary, subcampanulate, 1 cm long, 1.3–1.5 cm wide, calyced. *Involucral bracts* about 20, linear-lanceolate, 7–8 mm long, 1.5 mm wide, with acuminate apices. *Receptacle* honeycombed. *Ray florets* about 17, yellow. *Disc florets* numerous. *Pappus* of numerous barbellate bristles. *Achenes* glabrous.

*Senecio cryptolanatus* is a distinct species with yellowish green, somewhat fleshy, rosulate leaves. The plants seen by the author had red-margined leaves, a character which is not always evident in the dried material. All the collectors describe the flowers as yellow, but in the dried state the rays are almost white on the inner face and yellow on the outer. The plant flowers during March and April. The epithet *cryptolanatus* refers to the "hidden" tufts of wool in the axils of the leaves, bracts and involucrel bracts.

This species grows on the summit of the Drakensberg Mountains between 8,900 and 11,000 feet usually at the edge of small streams or pools. Its known distribution is from Doodman's Krans Mountain in the Barkly East District of the Eastern Cape to Mont aux Sources in Natal—a range of some 200 miles. *S. cryptolanatus* was first collected in March, 1898, by Maurice Evans, one of the earliest collectors in the Drakensberg area.

*S. cryptolanatus* has no very close ally, but is probably nearest *S. tugelensis* Wood and Evans, which differs in being caulescent. It is rather surprising that *S. cryptolanatus* has been collected in mixed gatherings with *S. tugelensis*; morphologically the two species are easily distinguishable and in addition they have a different ecology. *S. cryptolanatus*, as already pointed out, is a streambank or pool-edge plant, whereas *S. tugelensis* grows in alpine grassveld.



**Senecio praeteritus** Killick, sp. nov., affinis *S. brevidentato* M. D. Henderson, sed foliis radicalibus cordato ovatis non oblanceolatis differt.

*Herba* erecta, ad 40 cm alta, simplex, basi fibrosa. *Caules* glabri vel breviter pubescentes. *Folia* glabra; radicalia cordato ovata, laminis 1.2–2 cm diam. petiolis 2.5–3 cm longis, apice subacutis vel rotundatis, marginibus repando dentatis sub-reflexis; folia caulina inferiora oblanceolata vel spathulata, 2.5–5.5 cm longa, 0.8–1.8 cm lata, marginibus ut in foliis radicalibus; superiora lanceolata, 1.3–2.7 cm longa, 1–4 mm lata, basi auriculata amplexicaulia, obscure et sparse dentata. *Pedunculi* laxe corymbosi, raro simplices. *Capitula* radiata, calyculata, lutea. *Receptaculum* alveolatum. *Involucri bractee* circiter 20, lineares. *Flores* radii circiter 10. *Flores disci* numerosi. *Achaenia* juvenia glabra, tereta. *Pappi setae* numerosae, breviter barbellatae.

NATAL.—Bergville District: locally abundant, mountain side, Old Basuto Pass, National Park, 6,000 feet, Galpin 9739; locally frequent on streambank, Cathedral Peak Forest Influences Research Station, 6,800 feet, Killick 1796 (PRE, type).

Erect herb up to 40 cm high with a fibrous base. *Stems* simple, usually glabrous but sometimes minutely pubescent. *Leaves* glabrous, distinctly paler on the lower surface; radical cordate-ovate with the blade 1–2 cm diam. and petiole 1.5–3 cm long, apex subacute to round, margins repand dentate occasionally appearing crenate, sub-reflexed, teeth thickened; lower cauline oblanceolate to spathulate, 2.5–5.5 cm long, 0.4–1.8 cm wide, margins as in the radical leaves; upper cauline lanceolate, 1.3–2.7 cm long, 1–4 mm wide, auriculate and somewhat amplexicaul at the base, obscurely and distantly toothed. *Peduncles* laxly corymbose, rarely simple, with 1 or 2 linear bracts 2–6 mm long. *Heads* radiate, subcampanulate, 6–9 mm long, 6–8 mm wide at the summit, yellow, calyced. *Receptacle* honeycombed, angles of pits produced into subulate processes. *Involucral bracts* about 20, linear, 5–6 mm long, margins membranous, apex black-tipped, glabrous. *Ray florets* usually 10; tube 4–5 mm long, limb twice as long. *Disc florets* numerous, 7 mm long, widening above middle; lobes narrowly triangular, 1 mm long, 0.75 mm wide at base; style branches truncate, conspicuously hispid at tips; filaments thickened below anthers; anthers with incurved apical appendage. *Achenes* terete, glabrous. *Pappus* of numerous barbellate bristles.

This new species of *Senecio* was first collected in November, 1928, by E. E. Galpin. He found it growing at the side of the Old Basuto Pass in the Mont aux Sources area of the Drakensberg. Galpin describes the plant as "locally abundant". Twenty-four years elapsed before it was collected again, hence the epithet *praeteritus* meaning "passed-over". The author found the plant growing on a streambank in the upper reaches of the Indumeni Valley on the Little Berg in the Cathedral Peak area. There it is locally frequent.

The affinity of *S. praeteritus* seems to be with *S. brevidentatus* M. D. Henderson, which differs in having oblanceolate instead of cordate-ovate radical leaves.

A note by Dr. E. P. Phillips on the Galpin specimen states that the plant is "near *Senecio cordifolius* Linn. f." At first sight this seems possible; *S. cordifolius*, a S. W. Cape species, has the same three leaf shapes. However, this is another example of homoplastic similarity between unrelated species—in this case between two species of different genera for, as pointed out by Spencer Moore in Journ. Bot. 41, 406 (1903), L'Heritier in Sert. Angl. 25 transferred *S. cordifolius* to *Cineraria* renaming it *C. mitellaefolia*. In *C. mitellaefolia* the achenes are compressed as is characteristic of *Cineraria*, whereas in *Senecio praeteritus* the achenes are clearly terete.

## CONVOLVULACEAE.

*Ipomoea bisavium* A. Meeuse sp. nov., *I. heterosepalae* Baker affinis sed pedunculis longioribus praecipue differt.

Perennis, alte scandens. *Caules* lignosi teretes, ad ca 1 cm diam. cortice atr Brunneo vel nigricanti rugoso obecti, juveniles graciles adpresse puberuli. *Folia* firmiter herbacea in siccitate chartacea, ovato-cordata vel elongato-cordata, integra vel subcrenata, acuminata vel attenuata, mucronata basi late cordata vel subcordata, 3-7 cm longa 1.5-5 cm lata lobis basalibus rotundatis; lamina utrinque praecipue subtus minute adpresse pubescenti, glabrescenti costa et nervis secundariis gracilibus subtus paucè prominentibus petiolis gracilibus subteretibus dense adpresse puberulis 1-3 cm longis. *Inflorescentiae* axillares, pauciflorae, monochasiales vel interdum flores solitarii; pedunculus communis satis gracilis, teres, dense adpresse puberulus, ad 7 cm longus pedunculis secundariis ad 3 cm longis pedicellis gracilibus minute pubescentibus substriatis 0.5-2.5 cm longis; bracteolae submembranaceae ovato-lanceolatae vel oblongae, acutae, sparse puberulae, subciliatae, ca 6 mm longae 2-3 mm latae, deciduae. *Sepala* erecta, in vivo dilute virides in siccitate olivacea, extus pubescentia demum glabrescentia, inaequalia; 2 extiora cordato-triangularia lobis basalibus biauriculatis, subacuminata, subobtusata, margine plus minusve undulata, ca. 14 mm longa 8-9 mm lata; sepalum tertium semicordatum-subfalcatum, 10-11 mm longum 4-5 mm latum, 2 interiora minora, vix auriculata, oblonga-lanceolata, subacuta, 9-10 mm longa 2-3.5 mm lata. *Corolla* infundibularis, alba tubo ad basin intus violaceo; tubus ca 2 cm longus, limbus 4-6 cm diam., vix lobatus, 5-angulatus, patens cum 5 fasciis mesopetalis extus pilis albidis strigoso-pilosis. *Stamina* inaequalia, ad basim breve glanduloso-pilosa granulis pollinis spinulosis. *Pistillum* glabrum. *Capsula* ovoideo-conoidea, glabra, fusca, 10-12 mm longa, ca 8 mm diam. *Semina* plerumque 4, ca 4.5 mm longa, velutina et ad angulos cum linea pilorum longissimorum fulvidorum ca 7 mm longorum.

TRANSVAAL.—Zoutpansberg district: about 2 m. S. of Wyllie's Poort, *Meeuse* 10181 (flw. 2/4/1957, PRE, type); *Meeuse* 10237 (fruit 11/5/1957), isotypes in BM, BR, EA, K, L, SRGH.

A tall perennial climber, reaching the tops of the supporting trees. *Stems* woody, terete, attaining a thickness of about 1 cm near the base, in the older parts covered with a dark brown to blackish rough bark, the youngest twigs firmly herbaceous to wiry, green, adpressed-puberulous. *Leaves* firmly herbaceous drying chartaceous, ovate-cordate to elongate-cordate, entire or faintly crenate, acuminate to attenuate and mucronate at the apex, broadly and shallowly cordate to subtruncate at the base, with rounded basal lobes, on both surfaces, especially on the lower one, minutely adpressed-puberulous mainly on the nerves, more or less glabrescent; the midrib and the subparallelly arranged main nerves slender, slightly prominent beneath; the blade 3-7 cm long and 1.5-5 cm wide, the petiole slender, subterete, densely adpressed-puberulous, 1-3 cm long. *Inflorescence* axillary, cymosely few-flowered or occasionally reduced to a single flower; common peduncle rather slender, terete, densely adpressed-puberulous, up to 7 cm long; secondary peduncles of the monochasia resembling the common peduncles but slightly thinner, up to 3 cm long; pedicels slender, minutely pubescent, somewhat striate, 0.5-2.5 cm long; bracteoles submembranous, ovate-lanceolate or oblong, acute, sparsely puberulous and subciliate, about 6 mm long and 2-3 mm wide, early deciduous. *Sepals* erect, unequal, light green drying olive-green, finely pubescent outside, glabrescent, not or hardly accrescent in fruit; two outer sepals cordate-triangular, biauriculate by the basal lobes of the cordate base, subacuminate, subobtusate at the very apex, more or less undulate along the margin, about 14 mm long and 8-9 mm wide near the base; third sepal somewhat asymmetrical, semi-cordate-subfalcate, 10-11 mm long and 4-5 mm wide; the innermost two distinctly smaller, not or hardly auriculate at the base, oblong-lanceolate, subacute, 9-10 mm long and 2-4.5 mm wide. *Corolla*

funnel-shaped, white with the lower portion of the tube purple-mauve inside; the tube glabrous, about 2 cm long, the limb spreading; hardly lobed, 5-angled, 4-6 cm in diam; the midpetaline areas strigose-pilose with white hairs on the outside. *Stamens* unequal, white, at the base shortly glandular-pilose; pollen grains spinulose. *Pistil* glabrous. *Capsule* ovoid-conical, glabrous, brown when ripe, 10-12 mm long and about 8 mm in diam. *Seeds* normally 4, about 4.5 mm long, shortly velutinous with greyish or drab hairs and in addition bearing fulvous hairs 7 mm long on the angles.

This plant was discovered after the manuscript of a revision of the South African Convolvulaceae had gone to press. Specimens were sent to the herbaria in Brussels, Kew, Nairobi and Salisbury, where Professor W. Robyns, Mr. W. Marais, Dr. B. Verdcourt and Dr. H. Wild all failed to match it. Mr. Marais, who also tried to match it in the British Museum (Nat. Hist.) herbarium, and Dr. Verdcourt reported that its nearest relationship is obviously with *Ipomoea heterosepala*, a Somaliland species. Thanks are offered to all the botanists who so promptly answered my queries.

As the plant under discussion was collected in a place which was rather inaccessible until the opening of the new road to Wyllie's Poort, it is unlikely to be an introduction or a garden escape. The locality is on a dry rocky hillside northwest of the new road between the Punch Bowl and Wyllie's Poort, about two miles from the Poort. This locality was visited twice, in April, 1957, for flowering material, and again in May of the same year to collect the fruits. Only a single plant was seen, and the flowering and fruiting specimens are from the same individual. This species is named in honour of Dr. Allan V. Bird, M.D. of Johannesburg and his son Peter for their active assistance in the gathering of the specimens, which, in the dense thorn scrub of the type locality, was by no means a sinecure.

*I. bisavium* is closely related to *I. heterosepala* Baker, but according to the report received from Mr. Marais, differs in the following characters:—

	<i>I. heterosepala</i> .	<i>I. bisavium</i> .
Flowers.....	Almost invariably solitary	Inflorescence usually several-flowered.
Peduncles.....	1-1.5 cm long up to bracts and articulation.	Common peduncle 3-7 cm long.
Pedicels.....	1.5-2.5 cm long.	Up to 3 cm long.
Bracts.....	Small and narrow.	Elliptic, foliaceous.
Sepals.....	Ovate-cordate, acute.	Cordate, acute.

The seeds and apparently the colour of the corolla of *I. heterosepala* are unknown, but the differences indicated above, apart from the complete geographical separation, appear to be sufficient to warrant specific distinction.

Viable seeds were obtained which have germinated quite well and it is hoped that plants can be raised, so that this species can be figured for "Flowering Plants of Africa" in the near future.

A. D. J. MEEUSE.

#### CORRECTION.

"I wish to correct an erroneous statement which appeared in Dr. Meeuse's recent excellent account of the South African Convolvulaceae (Bothalia 6, 4: 1958). On reading through I noticed on page 753 the statement that the type of *Ipomoea aquatica* Forsk. at Copenhagen is not in accordance with the usual conception of that species. This statement should have applied to *Ipomoea biloba* Forsk. and a note concerning this is to be published in the Kew Bulletin. This error is entirely due to a misleading statement in the postscript of a letter I sent to Dr. Meeuse and I must apologise to him and to his readers."

B. VERDCOURT.



## EUPHORBIACEAE.

*Euphorbia rowlandii* R. A. Dyer, sp. nov., habitu acaule ramis 5-7-angulatis podariis corneis confluentibus cyma solitaria capsula plus minusve acute triangulata distinguitur.

Planta succulenta acaulis perennis armata, basi profunde ramosa ad 1.5 m alta. *Rami* suberecti simplices vel raro ramulosi, 5-7-angulati in segmentis 7-15 cm longis basin versus 3-5 cm latis superne angustioribus constricti, podariis corneis 2-aculeatis confluentibus, aculeis ad 1 cm longis. *Cyma* solitaria plus minusve 2-4 mm supra aculeos emittentia, breviter pedunculata, 3-cyatheis. *Cyathium* primum masculinum, cyathea lateralia 2, bisexualia; involucrem 4.5-5 mm diametro, glabrum, lobis parvis subquadratis fimbriatis et glandulis 5 transverse oblongis 2.5-3 mm latis contiguis integris flavis munitum. *Ovarium* breviter stipitatum; styli circiter 1.5 mm longi infra medium connati. *Capsula* circiter 9 mm lata plus minusve acute triangulata pedicello circiter 5 mm longo exserta.

## PLATE II.

TRANSVAAL.—Soutpansberg District; on rocky outcrop eight miles north of Punda Maria in Kruger National Park, *Rowland Jones* 48 in National Herbarium, Pretoria, No. 28636 (PRE, type); 48A in PRE No. 28637; *Codd* 5370.

A succulent shrub 1-2 m tall and about the same width, with a suppressed main trunk rising only very shortly above ground and producing many spreading-erect branches. *Branches* 5-7-angled, very rarely rebranched, constricted into segments 7-15 cm long; segments 3-5 cm broad near their base and narrowed gradually upwards to the base of the segment above, with the constriction about 2 cm broad; angles acute, winglike, with a narrow continuous horny margin, paired spines and rudimentary leaves. *Spines* in pairs about 1 cm apart, 5-10 cm long without prickles or with only rudimentary ones on either side of the leaf-base or scar. *Cymes* solitary, 2-4 mm above the spines, shortly pedunculate, consisting of 1 central male cyatheum and 2 lateral bisexual cyathia arranged in a plane parallel to the main axis; peduncle about 2 mm long and about as thick, bibracteate; involucre cup-shaped, glabrous, about 4.5-5 mm diam. with 5 glands and 5 small subquadrate, fimbriate lobes; glands contiguous, transversely oblong, 2.5-3 mm in their greater width, nearly flat on upper surface, yellow. *Ovary* on a short gynophore about 1 mm long with a small rim-like calyx; styles about 1.5 mm long, united below the middle, with free portions about 1 mm long, spreading, bifid at tips; ovule attached within a hood, filling the cell; capsule purple, more or less acutely 3-lobed, about 9 mm broad, seed globose, about 2.5 mm diam.

The first recorded specimen of the species was collected by Dr. L. E. Codd in 1949 when he visited Lt. Col. Rowland Jones, then in charge of the northern sector of the Kruger National Park with headquarters at Punda Maria. Lt. Col. Rowland Jones subsequently forwarded both flowering and fruiting material. It is now nearly 10 years since the plants were recorded by the two collectors as rare on the sand stone ridges 8-9½ miles north-west of Punda Maria and although a constant search has been maintained no further records have been made.

Several miles distant from the site of *E. rowlandii* occurs *E. confinalis* R. A. Dyer which undoubtedly is a fairly near relative in spite of the fact that it grows into a tree of about 25 ft. tall, generally has fewer angles to the branches and shows significant differences in the inflorescence. There is a close superficial resemblance to *E. waterbergensis* R. A. Dyer, which however, has more slender, parallel-angled branches and differs in details of the inflorescence.



The combination of characters to be given taxonomic importance are the trunkless habit, the segmented branches with 5-7 angles, the continuous horny margin to the angles, the shortly pedunculate solitary cymes with 3 cyathia developed in a plane parallel to the main axis and the relatively deeply 3-lobed capsule.

R. A. DYER.

*Euphorbia cussonioides* Bally, sp. nov., affinis *E. obovalifoliae* A. Rich., sed foliis rotundioribus, ramulis brevioribus, angustioribus, ad ramorum cacumina congestis, ovarii denique calyci sine processis distinguenda.

*Arbor* 20-25 m alta, succulenta, spinosa, trunco erecto, cylindrico, ad 12 m alto, 80 cm diametro, ramis primariis paucis, spiraliter dispositis, ascendentibus, teretibus, rare ramificis, ramulis numerosis ad cacumina coronatis. *Ramuli* usque 75 cm longi, segmentati, inter segmenta constricti, ramifici, 3- raro 4-angulati, angulis valde compressis, 2-3.5 cm latis, margine undulato vel obtuse dentato. *Podarii* in apicibus dentium dispositi, cornei, brunneogrisei, breviter triangulati, 5 mm longi, aculeis binis ad 1.5 mm longis, saepe obsoletis instructi. *Folia* sessilia, in transversum subrotunda, ad 9.5 mm longa, ad 10 mm lata, succulenta, mox decidua. *Cymae* 1-4, ex podario uno, 1-2 mm supra aculeos productae, perbrevisiter pedunculatae, 3 cythia gercentes. *Pedunculum* bibracteatum. *Bractee* late deltoideae vel late oblongo-ovatae, membranaceae, margine denticulato, 3 mm latae, 2.3 mm longae. *Cyathium* primum masculinum, deciduum. *Cyathium* bisexuale 6.5 mm diametro, in forma poculi, 5 glandulis flavoviridibus, in transversum reniformibus, 3.4 mm latis, 1.3 mm longis, margine integro, leviter incrassato, 5 lobis subquadratis, fimbriatis munitum. *Capsula* breviter exserta, erecta, glabra, profunde trilobata, 10-12 mm longa, 14-15 mm diametro. *Calyx* obtuse trilobatus, lobis breviter dentatis munitus. *Styli* usque basim divisi, erecti, ad 1.2 mm longi, apice bifidi. *Semen* subglobosum, 4 mm longum, 3.5 mm diametro, griseomaculatum.

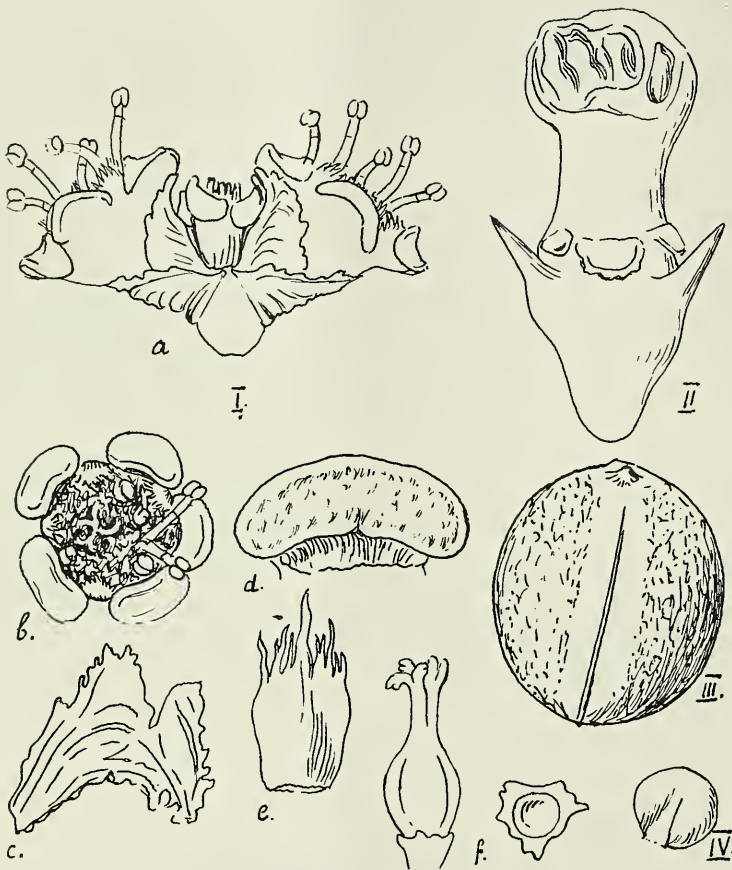
### PLATE III.

KENYA COLONY.—Southern Prov.; Ngong Dist., at Ngong, *McDonald* (Bally E 42) 8/1/39 (EA, type) (EA, type; Central Prov.: Fort Hall Distr., Meru-Sagana, *Jackson* (Bally E 171); Ndarugu, *Bally*; Thika, *Bally*; Gorge of Chania River, *Piers*. Embu Distr., *Bally*, (Phot. CVI, 36).

With a height up to 25 metres this species is one of the tallest and most imposing of the tree Euphorbias. Its comparatively late discovery in 1939, hardly twelve miles from Nairobi, is partly due to its habitat, tall mixed Highland Forest in which its lofty crown merges with the closed canopy, and partly to its general appearance. The crown of *E. cussonioides* consists of comparatively few ascending branches, crowned by clusters of short, thinly winged branchlets which, at a distance, resemble foliage; its general appearance is not unlike that of *Cussonia holstii*, which is expressed in the name of the new species. The type of forest in which *E. cussonioides* occurs comes under the category of "Mixed Highland Forest" which, in the neighbourhood of Nairobi, consists mainly of *Brachylaena hutchinsii*, *Croton macrostachys*, *C. megalocarpus*, *Calodendrum capense*, *Cussonia holstii*, *Olea clarysophylla*, *Strychnos* spp. *Teclea* spp., *Warburgia ugandensis*.

The range of distribution of *Euphorbia cussonioides*, as it is known at present, is restricted to the Kenya Highlands at altitudes between 4,500 ft. and 6,000 ft., where it occurs in a belt extending from the foot of the Ngong Hills just South of Nairobi north-east wards for about 90 miles as far as Embu, on the southern slopes of Mr. Kenya where the annual rainfall is between 34 and 60 inches. In spite of its fleshy branches and its small deciduous leaves this species is not a xerophyte.

The Kikuyu-name is "kithuri"; in Embu the tree is known as "mramba".

FIG. 1.—*Euphorbia cussonioides* Bally.

I.	a: cyme.....	1 × 4
	b: bisexual involucre.....	1 × 4
	c: bract.....	1 × 4
	d: gland.....	1 × 10
	e: lobe.....	1 × 10
II.	spine-shield.....	1 × 10
III.	seed.....	1 × 10
IV.	leaf.....	1 × 1

The timber is very soft, white and even-grained and should be well suited for the manufacture of matches. The copious latex is white. It hardens when drying to a guttapercha-like consistency.

A tree, 20–25 m high, fleshy, spiny, with an erect, cylindrical bole to 12 m high and to 80 cm diam. Branches few, spirally disposed, ascending, terete, sparsely branched, bearing at their tips numerous 3–4-angled, fleshy, green branchlets, branchlets up to

75 cm long, segmented, with constrictions between the segments; the segments up to 20 cm long, branching from the constrictions, 3- or rarely 4-angled, with angles much compressed, 2-3.5 cm wide, their margins undulate or obtusely dentate. *Spine-shields* disposed at the apex of the teeth, grey-brown, shortly triangular, 5 mm long, with a pair of thin spines up to 1.5 mm long, sometimes obsolete. *Leaves* sessile, transversely subrotund up to 9.5 mm long, 10 mm wide but mostly smaller, fleshy, soon deciduous. *Cymes* produced from the spine-shield, 1.2 mm above the spine-pair, one to four, very shortly pedunculate, bearing one central and two lateral cyathia each. *Peduncle* fleshy, with two lateral bracts. *Bracts* broadly deltoid, or obovate-oblong, membranous, 2.3 mm long, 3 mm wide, with a denticulate margin; central cyathium male, soon deciduous, lateral cyathia bisexual, 6.5 mm diam., cupshaped, bearing 5 not contiguous, reniform, greenish-yellow glands with entire, slightly thickened, raised margin, and with 5 subquadrate, fimbriate lobes. *Capsule* shortly exserted, erect, glabrous, deeply 3-lobed, 10-12 mm long, 14-15 mm diam. *Calyx* obtusely 3-lobed; its lobes shortly and irregularly dentate. *Styles* divided to the base, fleshy, erect, 1.2 mm long, with bifid apex. *Seeds* subglobose 4 mm long, 3.5 mm diam., grey with darker brown-grey spots.

P. R. O. BALLY.

### RHAMNACEAE.

*Ziziphus rivularis* L. E. Codd, sp. nov., *Z. pubescenti* Oliv. affinis, sed cymis sessilibus ovarii trilocularibus stylis 3 foliis glabrescentibus differt.

Frutex vel arbuscula ad 7 m altus inermis; ramuli cano-tomentosi. *Folia* petiolata lanceolata vel ovato-lanceolata serrulata glabrescentia, basi rotundata obliqua, apice acuta; petiolus 4-10 mm longus; lamina 3.5-6.5 cm longa, 1.2-3.4 cm lata. *Stipulae* minutae. *Cymae* axillares sessiles, floribus 1-5; pedicelli 1-1.5 mm, deinde frugibus maturatis 2.5-3 mm longi. *Calyx* 5-lobatus coriaceus, externe pubescens; lobi trianguli, 1.5 mm longi, apicem versus crassiores. *Corolla* minuta; petala 5, obovata unguiculata. *Stamina* 5, petalis opposita. *Orbis* carnosus, obscure 5-lobatus. *Ovarium* in orbe depressum, cellulis 3; ovula solitaria; styli 3, subulati. *Fructus* drupa globosus indehiscens, diametro 6-7 mm.

TRANSVAAL.—Soutpansberg: south end of Wyllie's Poort, *Gerstner* 6011; 6037; *Codd* 3009; 4823; 8348; Kruger National Park, Baiandbai, *Lang* in TM 32131; Shingwedzi River, *Lamont* 26; Pongola River, *van der Schijff* 3819. Nelspruit: Kruger National Park, beside stream in Lebombo Mountains, Crocodile Bridge Division, *van der Schijff* 3974 (PRE, type). Barberton: 6 miles south of Komatipoort, on banks of Komati River, *Codd* 7777.

MOCAMBIQUE.—Goba, *Hornby* 712; Umbeluzi, *Torre* 6503.

Shrub or small tree up to 7 m high, unarmed; bark grey, smooth; branchlets and innovations covered with a short, greyish tomentum. *Leaves* alternate, petiolate, lanceolate to ovate-lanceolate, serrulate, apex acute, base rounded, often oblique, from which three main nerves arise, sparingly pubescent on the nerves below and along the margin, becoming glabrous with age; petiole 4-10 mm long; blade 3.5-6.5 cm long and 1.2-3.4 cm broad. *Stipules* minute. *Inflorescence* an axillary, sessile cyme, consisting of 3-5 (rarely 1 or 2) shortly pedicellate flowers; pedicels 1-1.5 mm, elongating to 2.5-3 mm in the fruiting stage. *Calyx* 5-lobed, coriaceous, pubescent without; lobes triangular, 1.5 mm long with a thickened keel towards the apex within. *Corolla* minute; petals 5, obovate, clawed, truncate at the apex, attached between the calyx lobes. *Stamens* 5, opposite the petals; filaments 1 mm long; anthers 2-celled, medifixed. *Disc* fleshy, obscurely 5-lobed. *Ovary* superior, embedded in the disc, 3-celled; ovules solitary, erect; styles 3, free above the disc, subulate; stigma scarcely differentiated. *Fruit* globose, drupaceous, indehiscent, usually solitary in the leaf axil, 6-7 mm in diameter, dark brown when ripe, shortly pedicellate; endocarp and septa relatively thin, semi-woody; seeds usually 3 (rarely 1 or 2), compressed.

Material of this species has been accumulating at the National Herbarium for some years. Specimens were sent to Kew Herbarium and were reported to be unmatched in any species represented there. An attempt to name it in Suessenguth's treatment of the Rhamnaceae, Pflanzenfam. 20d (1953), was unsuccessful. It is unique among South African members of the genus in being unarmed and in having a 3-celled ovary with 3 styles, and a fruit in which the endocarp and septa between the cells do not develop into a hard, stony centre. Nevertheless, these are not characters which would exclude it from the genus *Ziziphus*.



FIG. 2.—*Ziziphus rivularis* L. E. Codd (van der Schijff 3974). 1, fruiting twig, natural size; 2, transverse section through fruit,  $\times 3$ ; 3, flowering twig,  $\times 10$ ; 4, flower,  $\times 10$ ; 5, section through flower,  $\times 10$ .



In vegetative characters it shows a close resemblance to *Z. pubescens* Oliv., but there are important floral differences. The main distinguishing features are summarised below:—

	<i>Z. pubescens.</i>	<i>Z. rivularis.</i>
Leaves.....	Persistently tomentose.	Glabrescent.
Cymes.....	Shortly pedunculate, several-flowered.	Sessile, 1- to 5-flowered.
Ovary.....	2-celled.	3-celled.
Styles.....	2.	3.
Fruit.....	Ovoid, apiculate.	Globose.
Endocarp and septa.....	Thick and woody.	Relatively thin, semi-woody.

*Z. rivularis* has so far been recorded only from the northern and eastern Transvaal and from the neighbouring region of Mocambique. Most collectors record that it is found on stream banks or in water courses, often among rocks, and this ecological character has suggested the specific name.

It may be noted that Suessenguth, l.c. (1953) cites the genus as *Zizyphus* Mill., Gard. Dict. Abridg. Ed. 4 (1754) and refers to a discussion on the spelling of the generic name by Loew in Flora der Juden, 3: 139 (1924). This work has not been consulted, but the main facts appear to be as follows: The species *Z. jujuba* Mill. was known in ancient times as “zizyphon” (Greek), “zizyphus” (Latin) and “Zizuf” (Arabic). It was listed by Dodonaeus (1616) as *Zizyphus* and by Linnaeus, Sp. Pl. Ed. 1: (1753), as *Rhamnus zizyphus*. However, Tournefort, Inst. Rei Herb. Ed. 3: 627, t. 403 (1719), although he cites Dodonaeus, spells the generic name as *Ziziphus* and Miller, basing his genus on Tournefort’s reference, adopted this spelling consistently in his fourth and subsequent editions. Even if it is argued that this is a philological error, it was deliberately used by Miller and would appear to be the spelling that must be taken up according to the rules.

L. E. CODD.

## SELAGINACEAE.

*Dischisma struthioloides* Killick, sp. nov., affine *D. squarroso* Schlechter, sed foliis angustioribus acutioribus differt.

*Fruticulus* multo ramosus, erectus, 30–60 cm altus, ramis divaricatis, partim albanatis, dense foliatis. *Folia* subreflexa, sessilia, anguste triangula, 3–5 mm longa, basi 1–1.5 mm lata, integra, utrinque glabra, plus minusve glauca. *Spicae* terminales, cylindratae, 1–3 cm longae; bractae foliis similes sed basi 2.5 mm latae et dimidio inferiore ciliatae. *Calycis segmenta* 2, libera, navicularia, 4 mm longa, 0.7 mm lata, ciliata. *Corolla* alba, tubo gracili, antice ad infra medium fisso, 1.1 cm longo, lobis 4, subaequalibus, oblongis, 2.5 mm longis, 1 mm latis, lobo quinto rudimentario, 0.8 mm longo, subulato. *Stamina* 4, superiora 1.5 mm longa, inferiora 0.5 mm longa, antheris 1.5 mm longis, medifixis. *Ovarium* 1 mm longum; stylus 3 mm longus, stigmatibus simplicibus, 2.5 mm longo.

CAPE PROVINCE.—Namaqualand: 11 miles east by south of Hondeklip Bay, Strandveld on dunes, c. 500 feet, *Acocks* 14941 (PRE, type); Hondeklip, *Pillans* 163.

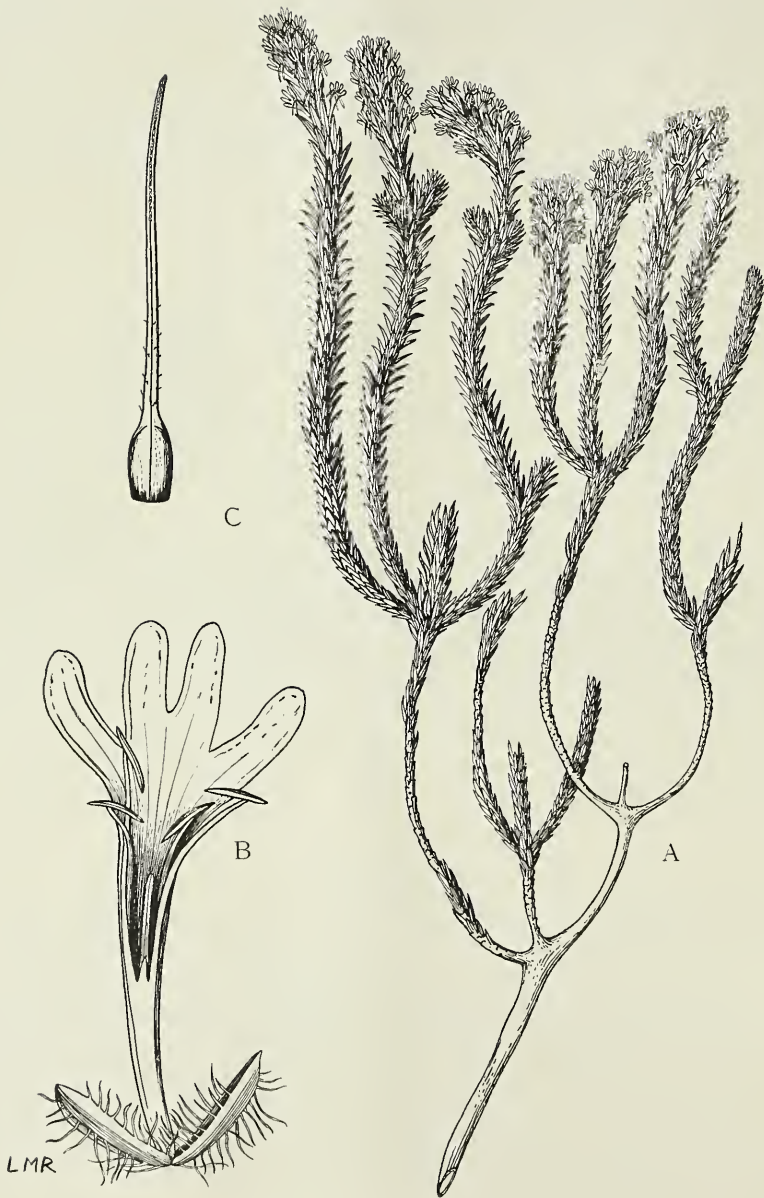


FIG. 3.—*Dischisma struthioloides* Killick : A, habit,  $\times 1$ ; B, flower,  $\times 10$ ; C, pistil,  $\times 20$ .

An erect, much-branched shrublet, 30–60 cm high. *Branches* divaricate, white-lanate in parts, densely foliate, older portions covered with persistent leaf-bases. *Leaves* slightly reflexed, sessile, narrowly triangular, 3–8 mm long, 1–2 mm wide at the base, glabrous, somewhat glaucous. *Spikes* terminal, cylindrical, 1–3·5 cm long; bracts similar to the leaves but 2·5 mm wide, almost ovate and ciliate in the lower half. *Calyx segments* 2, free, boat-shaped, acute, 4 mm long, 0·7 mm wide, ciliate. *Corolla* white; tube slender, 1·1 cm long, slit to just below half-way, lobes 4, subequal, oblong, 3 mm long, 1 mm wide, vestigial fifth lobe at base of slit, 1 mm long, subulate. *Stamens* 4, didynamous, upper 1·5 mm long, lower 0·5 mm long; anthers 1·5 mm long, medifixed. *Ovary* 0·5–1 mm long; style 3 mm long, with few scattered glands; stigma 2·5–3 mm long.

This new species of *Dischisma* from Namaqualand appears to have been collected only twice; first by Mr. N. S. Pillans in 1924 and then by Mr. J. P. H. Acocks in 1948. The specific epithet *struthioloides* points to the superficial similarity of this plant to species of *Struthiola* in Thymelaeaceae. So marked is this similarity that the Acocks specimen was originally misidentified as a *Struthiola*. The nearest ally of *D. struthioloides* is *D. squarrosus* Schlechter which, however, has broader and blunter leaves.

D. J. B. KILLICK.





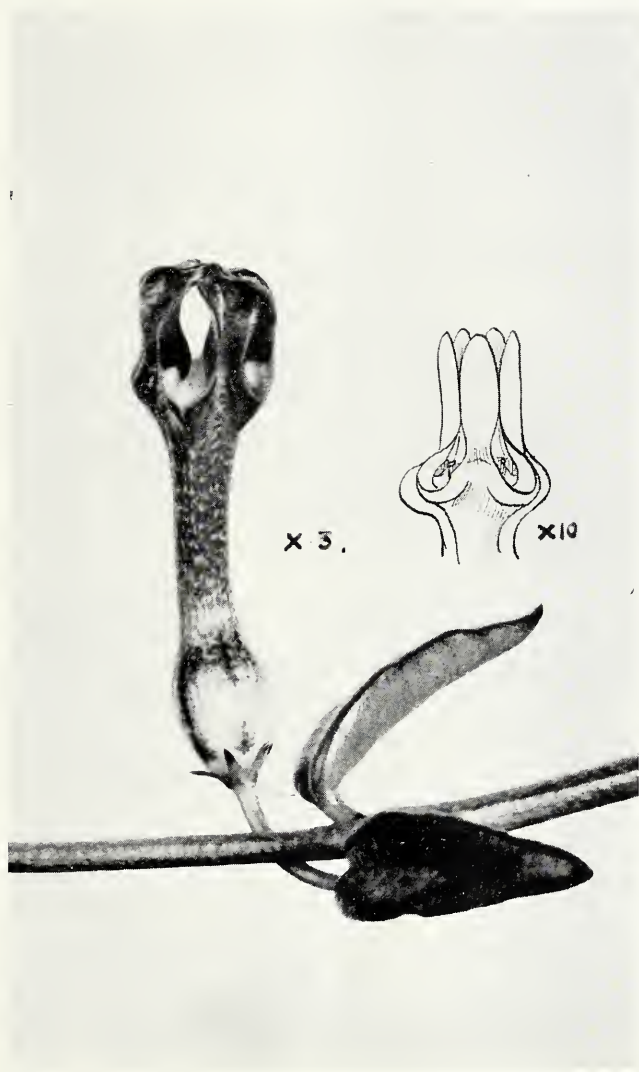


PLATE I.—*Ceropegia occulta* R. A. Dyer.

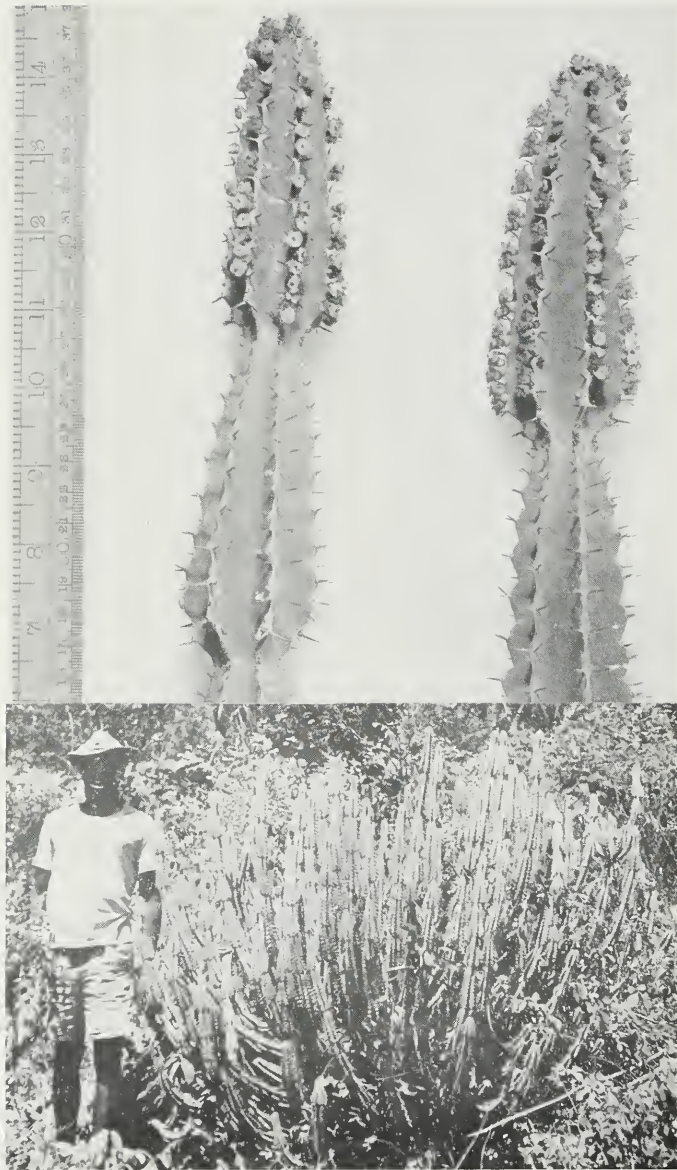


PLATE II.—*Euphorbia rowlandii* R. A. Dyer.



PLATE III.—*Euphorbia cussonioides* Bally.





# The Protea Species of the Summer Rainfall Area of South Africa.\*

By

J. S. Beard.

## INTRODUCTORY.

The genus *Protea*, R. Br. (*nom. cons.*), is distributed throughout Africa south of the Sahara with two main centres of distribution, the Cape *fynbos* and the Central African *Brachystegia* belt which stretches from Angola through the Rhodesias into Tanganyika. The former contains about 70 species, and the latter, as at present known, about 50. Four species only which are not represented within the tropical *Brachystegia* belt occur to the north of it, bringing the total for tropicals up to 54. For the summer-rainfall area of South Africa, which we may designate the sub-tropical belt linking the tropical and Cape centres of distribution, this paper will deal with 12 endemic species, bringing the total for the genus to 136. These are, therefore, equally divided between the Cape and the rest of Africa.

The summer rainfall area of South Africa is, for *Proteas*, essentially a transitional region and is thus in many ways of special interest. It is much poorer in species than the main centres to north and south which it links and the individual plants are less conspicuous in the landscape. Of the 15 species concerned, one (*P. laticolor*) is essentially a Cape *fynbos* species which extends its range into the southern part of our area, and two (*P. gagedi* and *P. hirta*) are tropical species of very wide distribution which come down into Natal. The remaining 12 species are endemic to the summer-rainfall area. None of them enters Cape vegetation to the southward or tropical vegetation to the north. Two of them, *P. subvestita* and *P. roupelliae*, are of Cape affinity, belonging to sections of the genus (*Exsertae*, *Ligulatae*) otherwise only represented among Cape *fynbos* species. Nine others belong to the typically tropical sections *Lasiocephalae* and *Leiocephalae*, while three belong to a new section which it is proposed to recognize, the *Patentiflorae*, which also contains a number of tropical species.

## TAXONOMY.

There have been only two complete treatments of the genus *Protea* in South Africa since R. Brown's work in 1810: Meisner in de Candolle's *Prodromus*, 1856, and Phillips and Stapf in the *Flora Capensis* Vol. V of 1913. The latter is therefore the foundation on which this paper rests. The taxonomy of *Protea* is in general very difficult and confused due to the horticultural popularity of the genus in Europe in the late eighteenth century and the consequent large amount of literature from that period. Fortunately for the present study, the summer-rainfall area *Proteas* were not discovered early enough to share in that confusion, and it is only one solitary intruder from the Cape flora, *P. laticolor* Salisb., which is likely to present difficulty. It may be remarked that whoever sets out to revise the Cape *Proteas* will have to undertake some very laborious research into the eighteenth century work.

\* (Preliminary account presented to the Annual Congress of the S.A. Association for the Advancement of Science, Nelspruit, 1956.)

Phillips and Stapf divided the South African species of *Protea* into 12 sections, arranged in two major groups; the first of these contained eight of the sections and consisted of arborescent plants, while the remaining four sections were placed in a group of suffrutescent plants having underground rootstocks. In the writer's opinion this major grouping is artificial and separates sections that should properly be united. We find the majority of summer rainfall species fall into the sections Ligulatae, Exsertae, Lasiocephalae and Leiocephalae, a treatment which it is proposed to follow. However, there are a number of dwarf species which would have to be placed among the Microgeanthae if Phillips and Stapf were followed literally; instead, they have been placed among the Leiocephalae where they clearly belong naturally. Furthermore, there are several others which may assume either a dwarf or arborescent habit according to growing conditions and degree of veld-burning.

Two of the newly discovered species described here, *P. comptonii* and *P. rubropilosa*, while closely related to one another, do not fit readily into any of the sections of Phillips and Stapf: their heads are much larger than in the Lasiocephalae and Leiocephalae, yet they are very distinctly different from any of the large-headed Cape sections. A curious feature, taken as diagnostic, is that the heads do not close again after anthesis while the fruit is maturing but remain wide open or *everted*, and the section is thus named *Patentiflorae*. Both heads and leaves are larger than in the Lasiocephalae and Leiocephalae, whose heads are uniformly closed after anthesis. The previously known species *P. curvata* is placed in this section, which will include also a number of the tropical species, notably *P. angolensis* Welw., *P. chionantha* Engl. and Gilg, *P. bella* Hauman and *P. madiensis* Oliv. The South African species are peculiar in that the growth-habit and bark of the trees and the leaves in the case of *P. rubropilosa* and *P. comptonii* are more typical of *Faurea* than of *Protea*, in particular resembling *Faurea galpinii*.

The treatment in this paper has perforce been based upon specimens in the South African herbaria, supported by a large amount of field study. The types of those species of more antique description are mostly in Europe, but they were obtained on loan for study for which thanks are due to the Directors of the herbaria at Kew, Berlin-Dahlem, Brussels and Leiden. Typification has been undertaken as prescribed in the international code. None of the authors of the species in question indicated holotypes. In cases where no duplicate specimens of the type have been traced the unicum has been designated the holotype. In other cases a lectotype has been selected, naming as far as possible a specimen which is at Kew or some other European herbarium.

#### DISTRIBUTION AND ECOLOGY.

In mapping the distribution of our species, use may be conveniently made of the vegetation map of the Union by Acocks, "Veld Types of S. Africa", which accompanies Botanical Survey Memoir No. 28.

The true Cape  *fynbos* which is the real home of the Cape species of *Protea* is confined to the winter rainfall area west of Uniondale. The constant rainfall zone contains a  *fynbos* mapped as "False Macchia" by Acocks which covers widely the various mountain ranges in the Uniondale, Humansdorp and Port Elizabeth Divisions and is prolonged in a narrow outlying strip along the Zuurbergen, around Grahamstown and at Riebeeck East. This False Macchia is much poorer in *Protea* species than the true Macchia further west and appears to contain only 19 of them. Fifteen of these do not range east of Uitenhage, the outlying area up to Grahamstown containing four species only.

North and east of this, across the Keiskama river and along the scarp front of the Winterberg and Amatola mountains, summer rainfall vegetation begins in the form of various types of grassveld which continue north right to the Limpopo. Here one can no longer expect to see *Proteas* more or less anywhere as is the case in the Cape  *fynbos*. Habitats are now much more restricted and the *Proteas* occur in localised patches. Most of the summer rainfall area is covered with grassveld, which is a fire climax: much of this again is potentially forest, though whether it has ever actually in whole

or part been forest in recent geological times is another matter. The Proteas do seem to indicate that forest has at least been rather more extensive than it is today. They do not themselves occur, of course, in forest but they are found naturally in conjunction with it. In many places today where there are forests on mountain sides one can study this conjunction. At the foot of the slopes the forest is on deep soil and is very luxuriant; higher up the soil becomes more and more shallow and rocky, and the forest is reduced in stature. Eventually, if the mountain is capped by extremely steep and rugged slopes, rock slabs or krantzies, the forest gives way abruptly to an open Protea woodland. There is little doubt from the relics that occur in protected situations that this open Protea woodland as we now see it is a remnant, decimated by fire, of a Macchia floristically and physiognomically similar to the Cape  *fynbos*. Acocks several times gives lists of associated Macchia species: various Ericaceae and Widdringtonia spp. were undoubtedly prominent but have been largely eliminated by fire. The Proteas are relatively fire-resistant and have survived. None the less there is a limit to their tolerance and all too many of the Protea colonies that one sees today are patently in a state of recession. The forest that they once bordered has long since disappeared, their associated shrubs have gone and now they themselves are threatened with extinction as the constant fires repeatedly eliminate their seedlings.

This ecological pattern is typical of the country along and to the east of the eastern escarpment, where we may only look for Proteas in the high rainfall areas and on sites too adverse for forest. In the central and western Transvaal the pattern changes into something much more suggestive of the tropics. Here, certain Protea species inhabit Acocks' Sour Bushveld and Bankenveld: in the former they are general and in the latter occur in the woodland which covers the rocky knolls, in both cases helping to make up a type of savanna woodland of distinctly tropical appearance. As before, however, we still find the Proteas occupying poor, rocky ground in the areas of highest rainfall.

As mentioned above, Acocks' Veld Types map has been drawn upon as an ecological basis for mapping Protea distribution, since the Protea species can be simply correlated with a small and defined number of veld types. The distribution of Proteas is not continuous, in fact it is highly erratic, and to map separately every single isolated locality of occurrence would be a formidable and rather unnecessary task. If, however, it is known in which veld types they are to be found, a map of the distribution of those veld types will divide the country within which locally Proteas may be found from that where they are absent. A "veld type" is not a plant community, it is really a landscape unit containing a mosaic of plant communities. Appropriate veld types contain Protea woodland as one of the components of the mosaic. Proteas occur in montane macchia in the following veld types:—

Acocks' Type 1, Coastal Forest and Scrub. 3, Pondoland Coastal Plateau Sourveld. 44, Highland Sourveld, with its unnumbered subdivision to the south, the Dohne Sourveld, and its separately numbered northern subdivision: 8, North-east Highland Sourveld. 45, Ngongoni veld of the Natal Mistbelt. 63, Piet Retief Sourveld (in part).

Proteas occur in savanna woodland in the following: 20, Sour Bushveld. 61, Bankenveld.

A small portion only of the Piet Retief Sourveld is affected, accompanying the escarpment of the Karroo rocks from Wakkerstroom north to the Swaziland border. It is probable that this strip should properly be regarded as a narrow extension of the Highland Sourveld.

With the exception of *Protea gaguedi* all our species occur within the boundaries of these veld types as mapped, unless here and there some mountain top carries a patch of the veld type too small to be separately mapped. *P. gaguedi* is typical rather of the ecotone between highland sourveld and bushveld and is thus frequently found slightly outside the borders of the above-mentioned veld types.



## KEY TO SECTIONS.

1. Bracts exceeding or equalling the perianth. .... 2.  
Bracts very much shorter than the perianth. .... 4.
2. Inner bracts spatulate, 2 mm wide in lower part, broadening to 10 mm wide at tip...I. *Ligulatae*.  
Inner Bracts oblong. .... 3.
3. Inner bracts pubescent, curved outwards away from the flowers: heads campanulate...II. *Exsertae*.  
Inner bracts glabrous, curved inwards to enfold the flowers: heads globose or turbinate. .... III. *Leiocephalae*.
4. Heads conical to globose, closing while the seed is ripening; perianth tube densely shaggy-hairy. .... IV. *Lasiocephalae*.  
Heads everted and open while the seed is ripening; perianth tube glabrous or at most lightly pubescent. .... V. *Patentiflorae*.

## ALTERNATIVE KEY TO SECTIONS.

Based on ratio total length of perianth to length of lip.

1. Ratio 2·5 or less: *Lasiocephalae*.
2. Ratio 2·5 to 3·0: *Ligulatae* or *Patentiflorae*.  
Length of teeth 12 mm: *Ligulatae*.  
Length of teeth 3-4 mm: *Patentiflorae*.
3. Ratio 3·0 to 3·5: *Leiocephalae*.
4. Ratio over 4: *Exsertae*.

## KEY TO SPECIES.

**Section I.—LIGULATAE.** Heads large, 8-12 cm long, conical, inner bracts red, spatulate, silky-tomentose, exceeding the flowers.

- Only species. .... 1. *P. rouppelliae*.

**Section II.—EXSERTAE.** Heads medium-sized, 5-7·5 cm long, campanulate, inner bracts white or pink, silky-pubescent, recurved at tip, exceeding the perianths but not the styles.

- Leaves hairy in youth, distinctly veined: Heads 6-7·5 cm long, perianth lip 14 mm. .... 2. *P. lacticolor*.  
Leaves woolly in youth, indistinctly veined: Heads 5 cm long, perianth lip 10 mm. .... 3. *P. subvestita*.

**Section III.—LEIOCEPHALAE.** Heads small to medium-sized, 4-8 cm long, globose or turbinate, bracts greenish tinged with red, glabrous, slightly incurved, more or less equalling the flowers.

1. Trees or divaricate shrubs: stems compound, flowering branchlets 5-15 mm thick. .... 2.  
Low shrubs or small creeping plants: stems simple, flowering branchlets 3-5 mm thick. .... 6.
2. Perianth 4 cm long, tube glabrous within. .... 4. *P. caffra*.  
Perianth 4·5-5 cm long, tube fulvously hairy within. .... 3.
3. Leaves falcate and more than 15 cm long. .... 6a. *P. rhodantha* var. *falcata*.  
Leaves straight and under 15 cm long. .... 4.
4. Most leaves less than 2·5 cm broad. .... 5. *P. multibracteata*.  
Most leaves more than 2·5 cm broad. .... 5.
5. Leaves thin, venation prominent: heads 7-8 cm long. .... 6. *P. rhodantha* var. *rhodantha*.  
Leaves thick, venation indistinct: heads 5-6 cm long. .... 7. *P. dracomontana*.
6. Leaves less than 15 mm broad. .... 7.  
Leaves more than 15 mm broad. .... 8.
7. Stems creeping: leaves all turned to one side of stem and very narrow, 7-10 mm broad. .... 8. *P. parvula*.  
Stems erect: phyllotaxis normal, most leaves 10 mm or more broad. .... 9. *P. simplex*.
8. Leaves less than 25 mm broad. .... 9.  
Leaves more than 25 mm broad. .... 10.
9. Heads 6 cm long, bracts 5 cm, perianth 4·5 cm, lip 15 mm. .... 10. *P. transvaalensis*.  
Heads 5 cm long, bracts 3·5 cm, perianth 3·5 cm, lip 10 mm. .... 9. *P. simplex*.
10. Venation prominent, leaves thin and turning black when dry: perianth lip 15 mm. .... 10. *P. transvaalensis*.  
Venation indistinct, leaves thick and turning grey when dry: perianth lip 12 mm. .... 7. *P. dracomontana*.



**Section IV.—LASIOCEPHALAE.** Heads small to medium-sized, 4–8 cm long (rarely to 10 cm), conical or globose, bracts greenish, hairy, with silvery or russet pubescence, very much shorter than the flowers.

1. Adult leaves glabrous; bracts covered with dense silvery pubescence; heads always solitary, terminal..... 11. *P. gaguedi*.  
Adult leaves hairy; bracts with thin silvery to russet pubescence; heads often lateral and/or clustered..... 2.
2. Leaves densely clothed with fine silky hairs and with longer russet hairs on the lower half of the midrib and base..... 12a. *P. hirta* subsp. *hirta*.  
Leaves apparently glabrescent but with closely adpressed silky hairs, especially on the base of the midrib..... 12b. *P. hirta* subsp. *glabrescens*.

**Section V.—PATENTIFLORAE.** Heads medium to large, 6–10 cm long, everted, bracts red or green, glabrous or hairy, very much shorter than the flowers.

1. Bracts densely rusty-pilose..... 13. *P. rubropilosa*.  
Bracts glabrous or virtually so..... 2.
2. Bracts green, flowers white; leaves 3–6 cm wide..... 14. *P. comptonii*.  
Bracts red, flowers pink; leaves 1–1.5 cm wide..... 15. *P. curvata*.

1. ***P. rouppelliae*** Meisn. in DC. Prodr. 14: 237 (1856); Phillips in F.C. 5: 573 (1913); Bews in Fl. Natal & Zulul.: 82 (1921); Burt-Davy in Fl. Pl. Afr., t. 133 (1924), Fl. Transv.: 211 (1926).

Type: Magaliesberg, Zeyher 1457 (K, holo.!).

*Scolymocephalus lanuginosus* O. Ktze in Rev. Gen Pl. 3: 279 (1891).

*Protea lanuginosa* K. Schum. in Just. Jahresb. 26, 1: 364 (1900).

*P. transvaaliensis* Gdgr. & Schinz in Bull. Soc. Bot. de France 50, 4: t. 13 (1913) non

Phillips. Type: Magaliesberg, Laidley 380 (L, iso.!).

*P. rudatisii* Engl. in Pflanzenwelt Afr. 3, 1: 66 (1915) nomen.

A small, gnarled tree 3–5 m in height and usually assuming a neat domed form with many spreading branches from a short trunk up to 20 cm thick. Bark black, rough, deeply fissured. Flowering branchlets 8–12 mm thick, hairy when young, rapidly becoming glabrous and developing a rough black bark. *Leaves* sessile or so narrowly attenuate at the base as to appear subpetiolate, closely ranked into terminal rosettes densely enveloping the flower heads, dark green, from linear-lanceolate to obovate or even obovate-spathulate, 1.5–4.5 cm wide by 6–16 cm long (average about 2.5 × 12 cm), 5 mm broad at the base, apex acute, base narrowed; blade leathery, often somewhat stiffened, glabrous and shiny on the upper surface after shedding an initial woolly covering, midrib prominent both sides, secondary venation ditto, reticulate, without a marginal vein. *Heads* solitary, terminal, 8–12 cm long and as much in diameter, conical, shortly pedunculate, opening to 90°. Receptacle convex, 15 mm wide. *Bracts* about 10-seriate, silky-tomentose and ciliate, the outermost brownish, short, ovate, obtuse, often recurved to revolute: middle bracts silvery-pink, obovate, up to 1.5 cm broad; the innermost 8–10 cm long, exceeding the flowers, pink to rose, spatulate, only 2 mm wide in their lower part, widening to 10 mm at the top. *Perianth* 7 cm long of which 1.5 cm for the base, 3 cm for the tube and 2.5 cm for the lip and teeth; base brown, glabrous, dilated, 3-keeled and 7-nerved; tube white, hairy, rather slender; lip densely hairy, from white below to deep red above; teeth covered with pink to crimson hairs, lateral teeth 12 mm, median tooth 8 mm long. Fertile stamens 3; filaments 1 mm long, flattened; anthers linear, 3 mm long; apical glands 0.5 mm long, oblong, acute; barren stamen acute, eglandular. *Style* white, 6 cm long, curved, somewhat flattened, keeled below on the convex side, usually more or less hairy: stigma red, 9 mm long, slender, apiculate, kneed and bent at the junction with the style. *Ovary* 4 mm long. *Fruit* 15 mm long clothed with reddish-brown hairs.

Flowering mainly in autumn.

TABLE OF FLORAL AND VEGETATIVE MEASUREMENTS (MILLIMETRES).

	<i>P. rouppellae</i> .	<i>P. lacteolor.</i>	<i>P. subvestita.</i>	<i>P. caltra.</i>	<i>P. multibracteata.</i>	<i>P. rhodantha</i> var. <i>falcata</i> .	<i>P. rhodantha</i> var. <i>rhodantha</i> .	<i>P. dracomontana.</i>	<i>P. parvula.</i>	<i>P. simplex.</i>	<i>P. transvaalensis.</i>	<i>P. gagei.</i>	<i>P. hirta</i> subsp. <i>glabrescens</i> .	<i>P. hirta</i> subsp. <i>hirta</i> .	<i>P. rubropilosa.</i>	<i>P. complan.</i>	<i>P. curvata.</i>
Thickness of branchlets.....	8-12	5-8	5-8	10	5-10	10-15	10-15	5	3	5	4	8-10	5-10	5	10	15-20	10
Leaf length.....	60-160	50-100	50-100	80-120	80-150	150-250	100-180	80-120	60-120	80-120	70-120	90-180	60-120	75-120	150	120-240	100-200
Leaf breadth.....	15-45	15-30	15-30	15-25	8-25	15-30	25-50	25-35	7-10	8-25	15-35	15-30	12-25	20-35	50	30-60	10-15
Ratio length: breadth.....	4-8	3-2	3-2	5-0	8-0	10-0	4-0	3-3	10-0	6-2	4-0	6-0	4-0	3-3	3-0	4-0	12-0
Head length.....	80-120	60-75	50	50-70	45-60	70-80	70-80	50-60	40	50	60	40-100	40-60	40-50	80-100	60-70	
Bract length.....	80-100	60-70	50	50	40	50	50	45	30	35	50	40	30	30	40	50	40
Max. width bracts.	15	10	10	20	15	20	20	20	15	12	20	20	12	12	20	25	15
Perianth total length.....	70	60	50	40	45	50	50	40	32	35	45	50	40-50	30	60	80	50
Lip.....	25	14	10	12	15	15	15	12	10	10	15	20	15-20	12	20	30	20
Ratio perianth: lip	2-8	4-3	5-0	3-3	3-0	3-3	3-3	3-3	3-2	3-5	3-0	2-5	2-5	2-5	3-0	2-7	2-5
Teeth.....	12	2	2	1	1½	1	1	2	1	2	1	1	3	2	3	4	3
Stigma.....	9	9	5	8	7-9	10	10	8	6	5	8	6-10	8	6	12	12	10

This is one of the most decorative and horticulturally noteworthy of the *Proteas* under discussion, having large and showy heads of a predominantly red colour. It is also the most widespread in distribution, ranging from Port St. John's to the Zoutpansberg, from sea level to 6–7,000 feet, and found in practically all the mentioned veld types. In the coast belt it ranges only from Port St. John's to Durban, accompanying the outcrop of the Table Mountain sandstone. Inland, this geological preference is abandoned and it ranges almost throughout, being absent from the Dohne Sourveld and the western end of the Transvaal Bankenveld.

There is considerable variation in size and shape of leaves throughout the extended range of this species and also, though to a lesser degree, in the size of the flower heads. As however, these variations are not consistent for given localities, it is considered inadvisable to attempt to recognize varieties. The specimens studied show plants from the Coast and Midlands of Natal frequently to have the largest and softest leaves whereas those from the Central Transvaal and the Waterberg are of the opposite extreme with short, stubby leaves, very stiff. North-eastern Transvaal and upper Natal specimens tend to be intermediate, with specially narrow-leaved types from East Griqualand. The size of flower-heads is reduced in unfavourable situations and vice-versa. Transvaal specimens appear to have the bracts more noticeably silver-tomentose without than Natal specimens, while along the eastern Transvaal escarpment heads are markedly green coloured, red being limited to the lip, stigma and tip of the bracts.

#### SELECTED CITATIONS.

CAPE.—Matatiele: *Baur* 4975. Maclear: *Galpin* 6822. Port St. John's: *Sim* 2547.

ORANGE FREE STATE.—Harrismith: *Witzieshoek, Flanagan* 1849.

BASUTOLAND.—Mafube: *Dieterlen* 946.

NATAL.—Nkandhla: *Qudeni, Gerstner* 1862. Pietermaritzburg: *Table Mt., McLean* 145. Inanda: *Groenberg, Medley Wood* 7918.

SWAZILAND.—Dalriach: *Bolus* 12266. Mbabane: *Burt-Davy* 2789.

TRANSSVAAL.—Pietersburg: *Blouberg, Codd and Dyer* 8980; 8984; *Strydpoortbergen, Maguire* 912. Rustenburg: *Magaliesberg, Zeyher* 1457; *Laidley* 380. Krugersdorp: *Mogg* 20259; 23204. Belfast: *Galpin* 13091. Lydenburg: *Sekukuniland, Barnard* 311. Soutpansberg: *Galpin* 14950. Pietersburg: *Houtbosch, Bolus* 10951. Pilgrim's Rest: *Graskop, Galpin* 14486. Barberton: *Burt-Davy* 353.

2. *P. lacticolor Salisb.* in *Parad. Lond.* t. 27 (1806); *Phillips* in *F.C.* 5: 578 (1913).

*Protea orientalis* *Sim* in *For. Flor. Cap.* 296: t. 128 (1907).

Type: *Pirie, Sim* 1478 (BOL, CTM, iso.).

A small spreading tree up to 4 m in height generally with a neat, domed form. Trunk up to 20 cm in diameter with grey smooth bark, horizontally ringed. Flowering branchlets 5–8 mm thick, somewhat woolly-hairy in youth, later glabrous with smooth pale brown bark. *Leaves* sessile, densely crowded into rosettes at the end of the branchlets, dark green, oblong, 1.5–3 cm wide by 5–10 cm long (average about 2.5 × 8 cm), apex obtuse or subacute, narrowed at the base; blade rigid, in youth covered somewhat with hairs which later disappear or persist only on the midrib or base, minutely punctate, distinctly veined: midrib yellow, slightly prominent both sides. Axillary buds conspicuous. *Heads* solitary, terminal, fairly constant in size, 6–7.5 cm long and as much in diameter when open, sessile, campanulate, expanding only to a narrow angle, enclosed by a few bracteolar foliage leaves. Receptacle flat to slightly convex,

12–15 mm wide. *Bracts* 6–8 seriate, the outer pinkish or greenish-brown, acute, silky-pubescent, ciliate and with an apical tuft of hairs: the inner either white or pink, 1 cm wide at broadest, tips obtuse, white-ciliate, recurved outwards, 6–7 cm long, exceeding the perianths but not the styles. *Perianth* very slender and thin in the upper half which is eventually spirally coiled up and withdrawn from the styles, reddish-hairy except at the base, 6 cm long of which 18 mm for the base, 28 mm for the tube and 14 mm for the lip; lip glabrous, 3-toothed; lateral teeth 1.5–2 mm long, red or white hairy; stamens all fertile, subsessile; anthers linear, 9 mm long, apical glands  $\frac{1}{2}$  mm long, ovate, obtuse, swollen on the inner face. *Style* white, glabrous, 6.5 cm long, straight, tapering above, compressed below, subterete above, grooved on one side; stigma red or white, very slender, 9 mm long passing with an abrupt thickening into the style. *Ovary* 3 mm long. *Fruit* curved, 5 mm long clothed with long brown hairs.

Flowers in late summer (February to April).

This species is essentially an inhabitant of the Cape  *fynbos*  from Worcester to Uitenhage, entering the summer rainfall area in the Amatola and associated mountains.

Its taxonomic identity has been accepted without critical study, following Phillips in *Flora Capensis*. The original description was in 1806 and the name ("milk-coloured") refers to the white colour of the heads. Actually pink-headed forms seem to be at least equally common. Perhaps for this reason Meisner changed the name to *P. latericolor* ("brick-coloured").

#### SELECTED CITATIONS.

CAPE.—Stockenström: Katberg, Dyer 369. Keiskamahoe: Hogsback, Beard 759. Stutterheim: Mountains, Flanagan 1703. King William's Town: Pirie, Sim 1478.

Phillips and Stapf in *Fl. Cap.* recognise a variety *orientalis* of *P. laticolor*, based upon a reduction of *P. orientalis* Sim of which the type is Sim 1478. After examining this specimen I am unable to establish any points of difference from the type of *P. laticolor* and accordingly cannot recognise the variety.

3. *P. subvestita* N.E. Br. in Kew Bull. 1901: 132; Phillips in F.C. 5: 578 (1913); Bews in Fl. Natal & Zululand. (1921).

Type: Faku's Territory (Pondoland), Sutherland s.n. (K, holo.).

The description given above for *P. laticolor* serves for *P. subvestita* likewise, with the following amendments:—

Branchlets distinctly woolly-hairy in youth. *Leaves* covered in youth with a dense woolly layer which is later dehiscent, leaving the blade glabrous or almost so: leaves rather more fleshy, so that venation is indistinct except sometimes on the upper surface and the blade can no longer be seen to be minutely punctate. *Heads* and flowers shorter. *Heads* 5 cm long, perianth rather more thickly hairy, teeth of the lip white-woolly. *Perianth* 5 cm long of which 15 mm for the base, 25 mm for the tube and 10 mm for the lip. *Anthers* 5 mm long. *Style* 5 cm, stigma 5 mm.

*P. subvestita* R. Br. is so close to *P. laticolor* that there was some temptation to reduce it in rank as a geographical subspecies. The distinguishing differences are merely such as one would expect to be associated with life at higher altitude in a more rigorous climate. *P. subvestita* is common on high mountains throughout the Highland Sourveld proper, seldom much below the 6,000 feet contour and favouring the steepest and most rocky places. None of the species of this section appear to have much fire resistance and are confined to sites where fires are less fierce.



## SELECTED CITATIONS.

CAPE.—Xalanga: Cala Mission, *Pegler* 1650. Maclear: Tent Kop, *Galpin* 6824. Umtata: Baziya Mountain, *Baur* 624.

BASUTOLAND.—Near Qacha's Nek: *Dieterlen* 993.

NATAL.—Underberg: *McClean* 678. Estcourt: Cathkin Park, *Galpin* 11748. Bergville: National Park, *Pardoe*, s.n. Klip River: Nr. van Reenen, *Medley Wood* 5631. Nkandhla: Qudeni, *Gerstner* 3945.

Note.—*Protea mundii* Klotzsch in Otto & Dietr. Gartenzeit. 1838: 113.

This is a winter rainfall species to which two collections from the summer rainfall area were wrongly allocated by Phillips in Fl. Cap.: Baur 624, the Baziya Mts., Umtata, and Flanagan 1703, mountains near Stutterheim. I have examined both above-numbered specimens in CTM and the former is *P. subvestita*, the latter *P. lacticolor*. It is noteworthy that Flanagan 1703 is also cited in Fl. Cap., with a slightly different locality, under *P. lacticolor*. *P. mundii* has thus never been collected east of van Staaden's Berg. It is very readily distinguished by its capitate stigmas.

4. *P. caffra* Meisn. in DC. Prodr. 14: 237 (1856); Phillips in F.C. 5: 585 (1913); Fl. Pl. Afr. t. 22, (1921), as *P. abyssinica*, in error; Burt-Davy in Fl. Transv. 211 (1926).

Type: Magaliesberg, *Zeyher* 1458 (*P. lecto.*!, CTM, iso.!).

A small gnarled tree up to 5 m in height, usually assuming a fairly neat domed form with many spreading branches from a short trunk up to 20 cm thick. Bark black, rough, deeply fissured. Flowering branchlets 10 mm or more thick (drying to less), grey-brown, glabrous. Leaves sessile, closely ranked on the flowering branchlets, pale green drying to grey-green, lanceolate or oblong-lanceolate, 1.5–2.5 cm wide by 8–12 cm long (average about  $2 \times 10$  cm), 5 mm broad at the base, apex subacute or obtuse, narrowed towards the base; blade leathery, stiff, glabrous, with a thin cartilaginous margin, midrib yellow, prominent both sides, secondary venation very indistinct even in dried specimens. Heads solitary, terminal, 5–7 cm long and as much in diameter, broadly globose, pedunculate with a rather solid woody stipes 1.5 cm long, opening to 90°. Receptacle slightly convex, 25 mm wide. Bracts 5-seriate above the stipes, at first very finely silky-tomentose, soon glabrous; those on the stipes scaly, greenish or brown, outer bracts of the head greenish developing brown tips, inner pink to red, obtuse, up to 5 cm long and 2 cm broad, slightly shorter than the flowers. The bracts are somewhat woody in this species. Perianth pinkish-white, glabrous except for fugacious hairs on the lip spirally coiled up and withdrawn in mature heads 4 cm long of which 12 mm for the base, 16 mm for the tube, and 12 mm for the lip; lateral teeth 1 mm long, median tooth under 1.5 mm; teeth tufted with fugacious tawny-white hairs. Stamens all fertile; filaments 0.5 mm long, flattened, concave; anthers linear, 9 mm long. Style white, 4 cm long, curved, tapering, flattened, keeled on both sides, glabrous; stigma 8 mm long, filiform, passing almost imperceptibly into the style. Ovary 6 mm long. Fruit 12 mm long, thickened towards the top and bent over, clothed with long brown hairs.

Flowers in summer (November to February).

*Protea caffra* Meisn. is characteristic of rocky ridges in the Transvaal Sour Bushveld and Bankenveld, to which areas it is confined except for outliers in the Lulu Mts. of Sekukuniland, and the mountains of the Leribe district of Basutoland. The specimens from these outlying areas have been very critically examined and are definitely *P. caffra*. In all cases this species inhabits drier, colder conditions than its relatives.

## SELECTED CITATIONS.

BASUTOLAND.—Leribe: *Dieterlen* 319\*.

TRANSSVAAL.—Waterberg: Naboomspruit, *Galpin* 11665. Rustenburg: Magaliesberg, *Zeyher* 1458. Krugersdorp: *Mogg* 20258. Heidelberg: *Leendertz* 7682. Pietersburg: Strydpoortberge, Welcome Mine, *Beard* 859. Lydenburg: Lulu Mts., *Mogg* 16885.

5. *P. multibracteata* *Phillips* in Kew Bull. 1910: 230; *Phillips* in F.C. 5: 586 (1913); *Bews* in Fl. Natal & Zululd. 82 (1921).

Type: British Kaffraria, *Cooper* 86 (K, lecto.!).

*Protea pegleri* *Phillips* in Kew Bull. 1910: 230. *P. natalensis* *Phillips* l.c.: 231. *P. baurii* *Phillips* l.c.: 232. *P. flanaganii* *Phillips* l.c.: 232, in part from syntype; Gwenkala River, *Flanagan* 804 (CTM).

An irregular gnarled tree 1–5 m in height. Trunk up to 15 cm thick, bark black, thick and fissured. Flowering branchlets 5–10 mm thick, glabrous, at first greenish or reddish. Leaves sessile, often fairly closely ranked at the ends of the branchlets, light green, from narrowly oblong to linear, 8–25 mm wide by 8–15 cm long (average about 12 cm long, width highly variable), sometimes somewhat falcate, apex subacute to subobtuse, narrowed at the base, sometimes so much as to appear sub-petiolate; blade soft, quite glabrous, midrib red, prominent both sides, secondary venation inconspicuous in fresh leaves, moderately conspicuous, finely reticulate and prominent both sides in dried specimens, uniting near the margin but with no true marginal vein. Heads terminal, solitary (or in some Eastern Cape specimens, clustered), 4.5–6 cm long and 5–8 cm in diameter, turbinate, generally peduncled with a small scaly stripes some 5 mm long, opening to 160°. Receptacle slightly convex, 15–20 mm wide. Bracts about 7-seriate above the stipes, the outer green, at first with a glaucous bloom, the inner greenish to red, colour variable; maximum width 1.5 cm (or 2 cm in some very large heads), 4 cm long, equalling or slightly shorter than the styles, oblong, obtuse. Perianth white, fulvously hairy within the tube, the lip edged with fugacious pink or brownish hairs, either densely or tipped only; perianth otherwise glabrous, 4.5 cm long of which 12 mm for the base, 18 mm for the slender tube and 15 mm for the lip; lateral teeth 1.5 mm long, median 1 mm; stamens all fertile, subsessile, anthers linear, 8 mm long; the perianth spirally coiled up and withdrawn in mature flowers. Style white, 5–6 cm long, slightly curved or wavy, somewhat compressed, glabrous; stigma usually pink, 7–9 mm long, filiform, obtuse, passing almost imperceptibly into the style. Ovary 3 mm long. Fruit 12 mm long clothed with golden-brown hairs.

Flowers in summer (November to February).

*P. multibracteata* *Phillips* ranges throughout Natal and the eastern Cape in all the mentioned veld types, from the steamy flats of the Zululand coast to the Drakensberg at 7,000 feet. and south to the Amatola Mts. This is a moderately severe habitat, with some extremes of heat and cold, less cold but much hotter than that of *P. caffra*. It is everywhere accompanied by the dwarf *P. simplex* *Phillips*.

The width of the leaves varies considerably in this species, being typically very narrow at the southern end of the range and growing steadily broader towards the north. The distribution is not in contact at any point with either *P. caffra* or *P. rhodantha*.

\* One of the two sheets of this number in the Natal Herbarium is *P. dracomontana* *Beard*.

## SELECTED CITATIONS.

CAPE.—Kentani: *Pegler* 1872. Komgha: Gwenkala River, *Flanagan* 804. Port St. John's: *Hutchinson* 1828. British Kaffraria: *Cooper* 86. Stockenström: *Katberg*, *Dyer* 370. Matatiele: *Baur* 4839.

ORANGE FREE STATE.—Drakensberg, Orange Free State: *Cooper* 951.

NATAL.—Umzinto: Umtwalumi, *Beard* 745. Pinetown: Springfield, *Medley Wood* 12822. Eshowe: *Gerstner* 1863. Stanger: Tugela Beach, *Johnson* 390; 620. Richmond: *Beard* 746. Bergville: National Park, *Bayer* and *McClean* 141; Cathedral, *Killick* 1061. Nkandhla: Qudeni, *Bayer* 791. Vryheid: Hlobane, *Johnstone* 436. Ubombo: Lebombo Mts., *Sargent* s.n.

SWAZILAND.—Lebombo Mts. S. of Stegi: *Verdoorn* 1679.

TRANSVAAL.—Amersfoort: Wakkerstroom, *Beard* 747.

Phillips in *Flora Capensis* sustained *P. multibracteata*, reducing to synonymy *P. pegleri*, *P. natalensis* and *P. baurii* which had been simultaneously published in 1910. *P. flanaganii* is now also reduced as it has not been possible to establish a separate identity for this species in the field (see further discussion under *P. simplex*).

6. *P. rhodantha* Hook. f., var. *rhodantha*, in Bot. Mag. t. 7331 (1893); Phillips in F.C. 5: 586 (1913); Burtt-Davy in Fl. Transv. 211 (1926).

Type: Cultivated at Kew, *Horn* s.n. (K, holo.).

*Protea bolusii* Phillips in Kew Bull. 1910: 231.

Type: Forbes Reef, *Bolus* 12265 (BOL, iso.).

*P. stipitata* Phillips l.c. 1934: 104.

Type: Haenertsburg, *Murray* s.n. (PRE, iso.).

Tree up to 15 feet in height, commonly rather less, branching low down and of rambling habit, trunk up to 50 cm thick, bark black, fissured, warty. Flowering branchlets 10–15 mm thick, glabrous, with smooth bark, at first green or pinkish, soon pale brown. *Leaves* sessile, crowded towards the end of the branchlets, green, oblong to oblanceolate, often slightly falcate or oblique, 2.5–5 cm wide by 10–18 cm long (average about  $3.5 \times 14$  cm), apex subacute, narrowed at the base; blade leathery, quite glabrous, with thin, transparent, cartilaginous margin, midrib red or yellow, prominent both sides, secondary venation reticulate, prominent both sides in dried specimens, with no true marginal vein. *Heads* terminal, solitary, or, rarely, clustered, 7–8 cm long and 12 cm in diameter, turbinate, pedunculate with a well-marked scaly stipes 1 cm long, opening to  $180^\circ$  at anthesis. Receptacle slightly convex, 25 mm wide. *Bracts* about 6-seriate above the stipes, the outer ovate, subacuminate, green or more or less pink, at first silky-pubescent below, ciliolate; inner oblong, deep rose-colour, glabrous, up to 2 cm wide and 5 cm long, equalling or slightly shorter than the flowers. *Perianth* white suffused with pink, glabrous except within the tube where it is fulvously hairy and at first on the lip, 5 cm long of which 15 mm for the base, 20 mm for the tube and 15 mm for the lip; tube expanded below, slender above, spirally coiled up in old flowers; lip clothed at first with orange hairs, soon glabrous; teeth subequal, recurved, 1 mm long. *Anthers* linear, 10 mm long. *Style* pink or white, 5.5 cm long, distinctly swollen just above the ovary, stout when fresh, when dry becoming compressed, grooved or quadrangular, curved, glabrous; stigma 10 mm long, filiform, slightly wavy at the junction with the style. *Ovary* 3 mm long. *Fruit* 12 mm long clothed with golden-brown hairs.

Flowers in summer (December to March).



*P. rhodantha* Hook. f. is characteristic of the north-east Highland Sourveld and thus of the eastern Transvaal and Swaziland. The habitat is wetter and milder than that of *P. multibracteata* and more genial than that of *P. caffra*. At the southern end of its range in the Barberton mountains and Swaziland this species is represented by its variety *falcata* in which the leaves become much longer, narrower and curved.

#### SELECTED CITATIONS.

SWAZILAND.—Forbes Reef: *Bolus* 12265. Mbabane: *Compton* 26343.

TRANSVAAL.—Soutpansberg: Between Rumble's farm and Lejuma Peak, *Reynolds* 4109; Entabeni, *Obermeyer* 872. Pietersburg: Haenertsburg, *Murray* s.n.; Wolkberg, *Beard* 861. Pilgrim's Rest: *Beard* 871; *Horn* s.n.; Mauchsberg, *Smuts* and *Gillett* 2261. Barberton: *Meeuse* 10107.

This species has been most difficult to elucidate. *Protea rhodantha* (the "red-flowered") was figured in the Botanical Magazine in 1893 with a description by Sir Joseph Hooker from a plant raised at Kew, the seed having been presented by Mr. W. J. Horn in 1886, collected at Pilgrim's Rest in the Transvaal. Unfortunately it is somewhat likely that a plant raised in a Kew greenhouse would differ from its wild prototype, particularly in point of size; furthermore the type material that has been preserved is inadequate, consisting only of a single leaf  $14.5 \times 3$  cm in size and a small head, detached and bisected, 5 cm long and 5 cm in diameter. It is hardly surprising that the species has been imperfectly understood.

In 1906 a collection of Dr. Bolus, No. 12265, was compared by him at Kew with the above type material of *P. rhodantha* and determined as that species. In Kew Bull. 1910 Phillips erected a new species, *P. bolusii*, upon this specimen but in Fl. Cap. (1913) reduced it to synonymy under *P. rhodantha*. The Bolus collection and the type are the only specimens cited in Fl. Cap. under *P. rhodantha*. In recent years specimens of a taxon found in the Natal Drakensberg have been referred to *P. rhodantha* on the authority of Kew, but no plants occurring in the Pilgrim's Rest district or elsewhere on the Transvaal Drakensberg have, so far as I am aware, been attributed to that species. In 1934 Phillips described a new species, *P. stipitata*, from Haenertsburg, "aff. *P. rhodanthae* Hook. f. sed foliis et capitulis majoribus, involucri bracteis numerosioribus inferne dense et molliter tomentosis differt".

The essential step towards an understanding of *P. rhodantha* was clearly an investigation as to what *Proteas* of the section *Leiocephalae* could be found in the Pilgrim's Rest district. This was carried out by Dr. A. D. Meeuse and myself in February, 1957, after first visiting at Haenertsburg the type localities of *P. stipitata* and *P. transvaalensis* and collecting them in flower. *P. stipitata* was found to be very common near Pilgrim's Rest, to the west on the road to Ohrigstad, to the east at Kowyn's Pass below Graskop and to the south all along the eastern slopes of the Mauchsberg and Mt. Anderson. At the very summit of Mt. Anderson some dwarf plants were found, sterile but apparently *P. transvaalensis*, and at the summit of the Long Tom Pass others, also sterile but demonstrably *P. parvula*.

The latter is distinctly different from *P. rhodantha* in its creeping habit and exceedingly narrow leaves. *P. transvaalensis* has about the same sized heads and leaves as the type of *P. rhodantha* but its leaves are distinctive, turning black when dried and of different shape: the head also is of different shape, long in proportion to breadth. It must be admitted that *P. stipitata* comes closest to *P. rhodantha*. The leaves are a very good match and the floral characters agree if we allow for reduction in size due to stunting in the Kew cultivated specimen. The common and conspicuous distribution of this form near Pilgrim's Rest makes it very likely that its seeds would have been collected by Mr. Horn. It is accordingly concluded that *P. stipitata* falls into synonymy under *P. rhodantha*.



The Natal Drakensberg specimens belong to a distinct species that is not found in the Pilgrim's Rest district and thus they cannot be *P. rhodantha*. They are placed under *P. dracomontana*.

6a. *P. rhodantha* Hook. f., var. *falcata* Beard, var. nov.

Type: Barberton, *Beard* 810 (PRE, holo.).

A varietate *rhodantha* foliis subter attenuatissimis, saepe quasi petiolatis, demissis, falcatis tamen subter inflexis, longioribus differt.

At the southern end of the range of this species, in the Barberton mountains, one finds mainly this varietal form which differs from typical *P. rhodantha* only in its very long, drooping and falcate leaves, as follows:—

Leaves frequently so long attenuate at the base as to appear petiolate, grey-green, drooping, very variable as to size and shape, linear-oblongate to oblanceolate, almost always falcate or at least curved in the lower half, 1·5–3 cm wide by 15–25 cm long (average about 2 × 20 cm), apex obtuse, base cuneate; blade glabrous, with a membranous margin, midrib sub-prominent, secondary venation indistinct.

SWAZILAND.—Ngwenya Mts.: *Compton* 835 in herb. J. S. Beard. Mbabane: *Compton* 23825.

TRANSVAAL.—Barberton: Makonjwa Mts., *Beard* 810; *Meeuse* 10117; *Pott* 5676; *Clarke* s.n.

7. *P. dracomontana* Beard, sp. nov.

Type: Cathedral Peak, *Killick* 1337 (PRE, holo.!, NH, iso.!).

Frutex divaricata 1–1·5 m alta, vel saepe nana ramulis simplicibus ex radice crasso editis. Folia elliptica, 3 cm lata, 10 cm longa, lamina crassa, rigida, glabra, margine translucante. Capitula terminalia, solitaria vel fasciculata, 5–6 cm longa. Involucris bracteae 5-seriatae, rubrae vel rubrescente-virides, ciliatae, 4·5 cm longae. Calyx punicea, tubo intus fulvo-piloso, limbo capillis fugacibus cristato. Stylus 4 cm longus, stigma 8 mm.

Potentially a divaricate shrub up to 1 metre tall, rarely 1·5 m, but most commonly adopting a dwarf form with numerous simple stems 30–50 cm long arising from a thick rootstock and repeatedly killed back by fire or frost. Shoots woody, 5 mm thick, bark reddish, glabrous. Leaves bluish-green, sessile, evenly spaced along the shoots, elliptic, 2·5–3·5 cm wide by 8–12 cm long (average about 3 × 10 cm), apex obtuse, base cuneate; blade thick, stiff, quite glabrous, midrib red, prominent both sides in the lower  $\frac{2}{3}$  of the leaf, secondary venation inconspicuous, the main veins slightly prominent below; margin translucent. Heads terminal, solitary or clustered, 5–6 cm long by 7 cm in diameter, oblong to turbinate, pedunculate with a small scaly stipes 0·5 cm long, opening to 180° at anthesis. Receptacle convex, 2 cm broad. Bracts about 5-seriate above the stipes, red or green edged with red, minutely ciliate, otherwise glabrous, up to 2 cm broad and 4·5 cm long, equalling or slightly exceeding the flowers. Perianth pink, fulvously pilose within the tube and on the lip (the latter hairs fugacious), otherwise glabrous, 4 cm long of which 12 mm for the base, 16 for the tube and 12 for the lip: teeth subequal, 2 mm long. Anthers linear, 6 mm long. Style white, flattened and grooved, 4 cm long, glabrous: stigma slender, 8 mm long, slightly wavy at the junction with the style. Ovary 2–3 mm long. Fruit 12 mm long clothed with golden-brown hairs.

PLATE I.

Flowers in summer.

Confined to the Natal Drakensberg from Underberg round to Leribe in Basutoland, at a high level between 6,000 and 8,000 feet elevation, on the basalt.

BASUTOLAND.—Leribe: *Dieterlen* 319 (in part).

NATAL.—Underberg: Himeville, *Bews* 36. Estcourt: Giant's Castle, *Bruyns-Haylett* 52; Highmoor Forest Reserve, v. *Rensburg* 4. Bergville: Cathedral Peak, *Killick* 1638; 1337, *Beard* 729; *Esterhuysen* s.n.; Ndedema, *Esterhuysen* 17367; Mweni, *Esterhuysen* 14673; National Park, *Hutchinson*, *Forbes* and *Verdoorn* 89; *Pardoe* s.n.; *Edwards* 505; 508.

The various collections of this species which exist in S. African herbaria have previously been referred to *P. rhodantha* Hook. f. On acquaintance with the population in the field, it is found to be a distinct taxon differing completely in its broad, fleshy leaves from any of the most nearly related species. As it does not occur in the Pilgrim's Rest district it cannot be *P. rhodantha* and is accordingly named as new.

### 8. *P. parvula* Beard, sp. nov.

Type: Dullstroom, *Galpin* 13149 (PRE, holo.!).

Suffrutex caulibus subterraneis, ramulis prostratis glabris. *Folia* sessilia, erecta, anguste lineare-oblongata, 8 mm lata, 8 cm longa, saepe aliquantum falcata, apice acuta, ad basin versus attenuatissima. *Capitulum* 4 cm longum, stipitatum. *Involuti* bracteae 5-seriatae, puniceae, glabrae, 3 cm longae. *Calyx* alba, glabra capillis paucis, 3.2 cm longa, limbus dentatus 1 cm longus, dentes 1 mm, cristati. *Stylus* 3 cm longus, glaber, compressus; stigma 6 mm filiforme, apice obtusum.

A small woody plant with branching underground stems 1–2 cm thick. Aerial flowering branchlets prostrate, 3 mm thick, glabrous with pale greenish to reddish bark. *Leaves* sessile, closely ranked, all turned to an erect position on the same side of the stem, light green, narrowly linear-oblongate, 7–10 mm wide at the broadest point by 6–12 cm long (average about  $0.8 \times 8.0$  cm), often somewhat falcate, apex acute to sub-rotundate, very long attenuate at the base: blade coriaceous, glabrous, with a thin membranous margin, midrib yellow, prominent below, sub-prominent above; secondary veins fairly distinct, arching and prolonged close to the margin so as to give the impression of a continuous marginal vein. *Heads* solitary, terminal, 4 cm long and as much in diameter when open, globose, pedunculate with a slender scaly stipes 7 mm long, opening to  $160^\circ$  at anthesis. Receptacle convex, 15 mm wide. *Bracts* 5-seriate above the stipes, pale pink, glabrous, up to 15 mm broad and 3 cm long, equalling the flowers, obtuse, shortly ciliate. Perianth creamy-white flushed with pink, glabrous except for a variable pilosity along the inner edges of the tube and the tufted teeth; 3.2 cm long of which 10 mm for the base, 12 mm for the tube and 10 mm for the lip: lateral teeth 1 mm long with a tuft of hairs. *Anthers* linear, 6 mm long. *Style* white, 3 cm long, glabrous, compressed and grooved, bulbously swollen above the ovary; stigma 6 mm, slender, obtuse, passing almost imperceptibly into the style. *Ovary* 2 mm long. *Fruit* clothed with long brown hairs.

Flowers in midsummer, (December to January).

This species is among the smallest of the creeping Proteas. It is localised on certain mountain tops in the Eastern Transvaal at 5,500 to 7,000 feet elevation, in very short grassland.

TRANSVAAL.—Belfast: Suikerboskop, *Galpin* 13149; *Bruce* 492. Pilgrim's Rest: Mariëpskop, Hebronberg, *Beard* 868. Lydenburg: Steenkampsberg, *Codd* 1715; *Acoks* 12922; Mount Anderson, *Smuts* and *Gillet* 2380; Makobulaan, *Beard* 874. Nelspruit: Kaapsche Hoop, on top of the mountain, *Phillips* 3464; v. d. *Merwe* 1538.

9. *P. simplex* Phillips in Kew Bull. 1910: 230; Phillips in F.C. 5: 588 (1913); Bews in Fl. Natal & Zulul. 82 (1921); Burt-Davy in Fl. Transv. 211 (1926).  
Type: Maclear, *Galpin* 6823 (K, lecto. PRE, BOL, GRA, iso.).

*Protea doddii* Phillips in Kew Bull. 1911: 82.

Type: East London, *Galpin* 7936.

- P. flanaganii* Phillips l.c. 1910: 232 in part, from syntype: Kentani, *Pegler* 274 (GRA, PRE, BOL, CTM).

A dwarf shrub with a thick underground rootstock from which arise numerous simple, ephemeral erect stems, 5 mm thick and up to 50 cm long, glabrous with pink to green bark. *Leaves* sessile, deep green, arranged all along the shoots, from narrowly oblong to linear, very variable as to size, (especially in width), from 8–25 mm wide by 8–12 cm long (average about 16 mm × 10 cm), apex subacute to sub-obtuse, base cuneate; blade leathery, glabrous, midrib red or yellowish, prominent both sides, secondary venation prominent. *Heads* solitary, terminal, 5 cm long and as much in diameter, turbinate, generally peduncled with a small scaly stipes some 5 mm long, opening to 160° at anthesis. Receptacle convex, 15 mm broad. *Bracts* about 5-seriate above the stipes, the outer green, the inner greenish to red, 3·5 cm long and up to 12 mm broad, equalling or slightly shorter than the styles. *Perianth* white, fulvously hairy within the tube, the lip edged and tufted with fugacious pink or brownish hairs; perianth otherwise glabrous, 3·5 cm long of which 10 mm for the base, 15 mm for the tube and 10 mm for the lip; teeth up to 2 mm long with fugacious tuft of orange hairs. *Anthers* linear, 6 mm long. *Style* white, 4 cm long, somewhat compressed, glabrous; stigma usually pink, 5 mm long, filiform, obtuse, passing almost imperceptibly into the style. *Ovary* 2 mm long. *Fruit* 12 mm long clothed with golden-brown hairs.

Flowers in summer.

Found in the Dohne Sourveld, Highland Sourveld and Coast Belt, accompanying *P. multibracteata*, also in the N.E. Highland Sourveld in Swaziland.

#### SELECTED CITATIONS.

CAPE.—East London: *Dodd* in Herb. *Galpin* 7936. Keiskamahock: *Story* 3836. Kentani: *Pegler* 274; 1871. Lusikisiki: *Galpin* 10999. Xalanga: Cala, *Pegler* 1651. Maclear: *Galpin* 6823.

NATAL.—Inanda: Field's Hill, *Medley Wood* 12316. Eshowe: *Lawn* 350. Underberg: *McClean* 725. Bergville: Champagne Castle, *Bayer* 1440. Lion's River: Howick, *Parkinson* s.n. Nkandhla: Qudeni, *Gerstner* 639. Pietermaritzburg: *McClean* 153. Umvoti: Greytown, *Galpin* 14836.

SWAZILAND.—Mbabane: *Bolus* 12264; *Burt-Davy* 2896. Forbes Reef, *Burt-Davy* 2767.

After field study and consideration of the herbarium material I have come to the conclusion that there is no valid reason for the separation of *P. doddii* which is accordingly reduced. There has further been a strong feeling towards reducing both these species under *P. multibracteata*. The following long-hand note by E. E. Galpin was found on an isotype specimen of *P. doddii* in the Albany Museum: "I am very doubtful as to whether *P. multibracteata*, *P. flanaganii*, *P. simplex* and *P. doddii* are not all varietal forms of one species. The length of the scaly stipes supporting the flower head and causing it to be either pedunculate or sub-sessile, from examination of specimens of *P. multibracteata* from the same spot appears to me to be a matter of luxuriance". Galpin had a profound knowledge of plants in the field. Support has now been lent



to his view by the reduction of *P. flanaganii* partly under *P. multibracteata* and of *P. doddii* under *P. simplex*, leaving us with two species, one arborescent and one dwarf, which clearly stand in a special relation to each other.

The ranges of these two species are almost identical and they almost invariably accompany one another in the same locality, the main exceptions being in the Natal Drakensberg where *simplex* forms are rare, and in Swaziland where *P. multibracteata* is absent. A few of the herbarium specimens seem to be intermediate and intermediate forms have been found in the wild though unfortunately always sterile. There is a sharp distinction between the species in stature and habit: otherwise the only difference in vegetative and floral characters is in size, all parts being proportionately smaller in *P. simplex*. It is suspected that *P. multibracteata* carries a gene for miniature habit, which may be selected by veld burning, leading to the establishment of dwarf populations which are genetically incapable of assuming an arborescent habit even if protected against veld fires. This theory is being tested experimentally. In the meantime, pending clarification of the relationship between them the two species are conserved separately.

10. *P. transvaalensis* Phillips in Kew Bull. 1911: 84; Phillips in F.C. 5: 587 (1913); Burtt-Davy in Fl. Transv. 211 (1926).

Type: Pietersburg, *Burt-Davy* 5179 (K, holo.).

A small dwarf shrub with numerous ephemeral simple stems 20–30 cm long arising from an underground rootstock. Stems 4 mm thick, glabrous, pale green or pink. *Leaves* spaced along the stems, sessile, bright green, black when dried, linear-elliptic to oblong, 1.5–3.5 cm wide by 7–12 cm long (average about  $2 \times 8$  cm), apex obtuse, base cuneate: blade erect and somewhat stiffened, glabrous, midrib yellow or red-veined, prominent both sides, secondary venation ditto, margin translucent. *Heads* solitary, terminal, 6 cm long and as much in diameter, narrowly cylindrical-turbinate, pedunculate with a small stipes 0.5 cm long, or virtually sessile opening to  $130^\circ$  at anthesis. Receptacle convex, 15 mm wide. *Bracts* only 4-seriate, pale green, glabrous, the innermost commonly pink-tipped and with a fugacious russet pubescence in the upper part, up to 2 cm broad and 5 cm long, acute, equalling the flowers. *Perianth* white, fulvously hairy within the tube, the lip clothed at first with fugacious tawny hairs, otherwise glabrous; 4.5 cm long of which 15 mm for the base, 15 mm for the broad tube and 15 mm for the lip; teeth indistinct, laterals 1 mm long. *Anthers* linear, 10 mm long. *Style* white, 5 cm long, glabrous, terete: stigma pinkish, 8 mm long, passing almost imperceptibly into the style. *Ovary* 3 mm long. *Fruit* 10 mm long, clothed with golden-brown hairs.

Flowers in summer.

This is a small low-growing species found in mountain grasslands of the Haenertsburg area.

There is some confusion as to the type locality. The sheet bearing the type at Kew (*Burt-Davy* 5179) is marked "Goedgeluk, Zoutpansberg" and is so cited in F. Cap. However, in Fl. Transv. 1: 211 *Burt-Davy* cites his own number 5179 as "Pietersburg, Houtboschberg" while his register says "hillsides above Diepkloof". We have not been able to trace any such locality at Goedgeluk, but the farm Diepkloof is a short distance to the north of the Houtboschberg. The type therefore evidently came from somewhere on the Woodbush ridge.

TRANSVAAL.—Pietersburg District, Haenertsburg area: Houtboschberg, *Burt-Davy* 5179; Suikerbosrand, *Thompson* s.n.; *Beard* 858; Iron Crown, *Beard* 860; Wolkberg, *Beard* 862; *Meeuse* 9861.



11. *P. gaguedi* Gmel. in Ed. 13, Linn. Syst. Nat. 2, 1: 225 (1791).

*Protea abyssinica* Willd. in Species Plantarum 1: 522 (1798). R. Brown in Trans. Linn. Soc. 10: 85 (1810); Richard in Tent. Fl. Abyss. 2: 232 (1851); Meisner in DC. Prodr. 14: 237 (1856); Phillips in F.C. 5: 581 (1913); Baker and Wright in F.T.A. 6, 1: 199 (1913); Bews in Fl. Natal & Zululand. 82 (1921); Burt-Davy in Fl. Transv. 211 (1926).

Type: none appears to have been preserved.

*P. trigona* Phillips in Kew Bull. 1910, 230.

Type: Pretoria, Leendertz 679 (PRE, iso.).

*Gaguedi* (nom. vern.) Bruce, Abyss. 5: 52 (1790).

Small gnarled tree not exceeding (in South Africa) 4 m in height, generally 2 m, less in adverse situations. Trunk 10 cm in diameter with pale brown, flaky, bark. Flowering branchlets 8–10 mm thick, drying to 5 mm, pubescent when young, soon glabrous and developing a thin dehiscent and papery bark cracking to show a reddish mealy surface beneath. *Leaves* sessile, closely ranked, light green, linear-lanceolate or -oblanceolate, 1.5–3 cm wide by 9–18 cm long (average about  $2 \times 12$  cm), 4–8 mm broad at the base, sometimes slightly falcate, apex obtuse, base cuneate, blade leathery, glabrous except in extreme youth when it may be densely pubescent, midrib yellow, prominent both sides, secondary venation finely reticulate, prominent both sides in dried specimens, no distinct marginal vein. *Heads* solitary, terminal, varying considerably in size from 4–10 cm in length and as much in diameter, broadly globose, generally pedunculate with a well marked scaly stipes 1.5 cm long, though some heads are virtually sessile: opening to  $160^\circ$  at anthesis. Receptacle slightly convex, 15 mm wide. *Bracts* about 6-seriate above the stipes, pale green with dense silvery pubescence, sometimes rose tinted above, 2 cm wide at their broadest, up to 4 cm long, much shorter than the flowers, obtuse with short white ciliate fringe. *Perianth* densely hairy, the base and tube whitish or fulvous, lip pure white or rose tinted, 5 cm long of which 1 cm for the base, 2 cm each for the tube and lip; tube glabrous within, lip covered with shaggy hairs except on the back which is glabrous or almost so, or with a line of hairs along the median keel; teeth not readily distinguishable, about 1 mm long. *Anthems* linear, 10 mm long. *Style* white, about 6 cm long, glabrous, flattened or triangular below, terete above: stigma white, slender, 6–10 mm long, passing with a slight bend, into the style. *Ovary* 3 mm long. *Fruit* 1 cm long clothed with pale golden-brown hairs.

Flowering mainly in winter.

*P. gaguedi* Gmel. ranges right through tropical Africa as far as Abyssinia, where it was first found and described. "Gaguedi" is a vernacular name in those parts. In the Union, it follows the eastern escarpment, with interior outliers only on the Magaliesberg, right down from the Zoutpansberg into Zululand where a collection of the writer's establishes its extreme southerly limit at the gorge of the Insuizi river in the Nkandhla district, just north of the Tugela. Sometimes this species is found within the North East Highland Sourveld, often just outside it, under rather drier and hotter conditions merging to Bushveld. It seems to demand less rainfall than others and is generally found on the rockiest of ground.

#### SELECTED CITATIONS.

NATAL.—Utrecht: Thode A385. Ngotshe: Louwsburg, Dyer 5029. Nkandhla: Insuizi River, Beard 799.

SWAZILAND.—Mbabane: Miller 5142.

TRANSVAAL.—Soutpansberg: Makonde, *van Warmelo* 5117/9. Pietersburg: Wolkberg, *Gerstner* 5607. Pilgrim's Rest: *Galpin* 14312. Barberton: *Thorncroft* 3061. Pretoria: *Leendertz* 679. Rustenburg: *Pegler* 941.

This species is the subject of the only name change effected in this paper, being the one hitherto known in South Africa as *P. abyssinica* Willd. The evidence supporting this change is as follows. A plant in the vicinity of Lamalmon, Abyssinia, was described in semi-technical terms under its native name Gaguedi by Bruce in his "Travels to Discover the Source of the Nile" 1790, with two illustrations. This plant was named scientifically as *Protea gaguedi* by Gmelin in his edition (No. 13) of Linnaeus' Syst. Nat. in 1791 and as *Protea abyssinica* by Willdenow in Species Plantarum, 1798. As both authors made it clear that they were describing Bruce's plant, there is no doubt that *P. gaguedi* is the valid name. We next have to decide whether our South African plants are conspecific with Bruce's, which might be a thorny problem since the eighteenth century descriptions are of the briefest and vaguest and Bruce's illustrations are stylised and might be almost any *Protea*. Fortunately, only one species of *Protea* has ever been collected in Abyssinia and we can thus be tolerably certain that it is *P. gaguedi*. South African specimens believed to be *P. gaguedi* have been compared at Kew with Abyssinian material by Mr. D. J. B. Killick at the writer's request and pronounced identical. *P. trigona* Phillips is now reduced to synonymy under *P. gaguedi* after examination of an isotype in the Transvaal Museum collection.

12. *P. hirta* Klotzsch in Flora, 76 (1845) and Beitrag Fl. Kap.- und Natal, 140 (1846), aggregate species.

Shrub or small tree, up to 3 m in height, rarely in dwarf form with underground rootstock emitting numerous stems up to 70 cm tall, almost invariably simple. *Stems* pale green to brown or silvery when young, densely hirsute, at length brown and glabrous, up to 10 mm thick. *Leaves* sessile, numerous, russet-green, oblong to oblanceolate, 2-3.5 cm wide by 6-12 cm long (average about  $3 \times 10$  cm), apex rounded or acute, base broad, rounded and even slightly auriculate: blade leathery, densely clothed with fine silky white hairs, and with longer russet hairs on the lower half of the midrib and base: midrib prominent both sides, secondary veins not numerous, irregular, prominent both sides, uniting to form an irregular marginal vein. *Heads* terminal or lateral, solitary or clustered, 4-6 cm long and 5-7 cm in diameter when fully open, conical, generally pedunculate with a small scaly stipes 1 cm long: opening to  $180^\circ$  at anthesis. Receptacle slightly convex, 12 mm wide. *Bracts* 4-8 seriate above the stipes, russet-green to yellow, often pink in bud, densely silky-tomentose, 12 mm wide at their broadest, up to 3 cm long and equalling or only slightly shorter than the flowers, obtuse, shortly ciliate at the tip. *Perianth* densely whitish-hairy, 3-5 cm long of which 8-10 mm for the base, 10-20 mm for the tube and 12-20 mm for the lip; tube glabrous within, lip covered with shaggy hairs except on the back which is glabrous or almost so, or with a few hairs along the median keel; lateral teeth 2-3 mm long, intermediate much shorter, tufted with russet hairs. *Anthems* linear, 6 mm long, connective shortly produced into a capitate gland. *Style* white, 3-5 cm long, flattened, curved; stigma 6-8 mm long, filiform, passing with an S-bend into the style. *Ovary* 4 mm long. *Fruit* 6 mm long, clothed with pale, straw-coloured hairs.

Flowering in mid-summer to autumn.

*P. hirta*, aptly "the hairy *Protea*" was the earliest of the summer rainfall *Proteas* to be discovered, collected in Natal by Krauss at the early date of 1838. The type locality, *ad radicem montium Tafelberge prope fluv. Umblaas, Natal, alt. 800-1,500 ft. (bunt. Sandstein)*, is thought to be somewhere near Mariannhill. For some time there was doubt as to the identity of Transvaal plants which do not conform entirely to the Natal type. This difficulty has been resolved by the foundation of a new subspecies, *glabrescens*. In the course of fieldwork in Rhodesia and East Africa it became clear

that *P. hirta* also extended there, although it had hitherto been classified under a number of different names. After examination of the types of these species they can now be reduced to synonymy under the aggregate species though more field work will be required before they can be divided into subspecies. These are:

SOUTHERN RHODESIA.—*P. swynnertonii* S. Moore in J. Linn. Soc. Bot. 40: 184 (1911). The type (Swynnerton 1411) can no longer be found at the British Museum. From description, however, and from collecting in the type locality, there is no hesitation in reducing the species.

ANGOLA.—*P. welwitschii* Engl., Hochgebirgsfl. Trop. Afr. 196 (1892). The syn-types, (Welwitsch 1600 and 1602 B) show somewhat narrow leaves and if this proves typical of Angola specimens, recognition of a subspecies will be appropriate.

BELGIAN CONGO (KATANGA).—*P. obtusifolia* de Wild. in Ann. Soc. Sc. Brux. 40, 2: 84 (1921) non Buck ex Meisn. in DC. Prodr. (1856). This was reduced to synonymy under *P. goetzeana* Engl. by Hauman in Bull. Jard. Bot. Brux. 17 (1946). In any case the name is illegitimate, being preoccupied.

Type: Homble 1253 (BR).

BELGIAN CONGO.—*P. congensis* Engl. Jahrb. 33: 129 (1904).

Type: Descamps s.n. (B).

UGANDA.—*P. melliodora* Dale in Indigenous Trees of the Uganda Protectorate, non Engler & Gilg. Greenway & Eggeling 7069 (EA).

TANGANYIKA.—*P. goetzeana* Engl. Jahrb. 30: 298 (1902).

Type: Goetze 1367 (B).

*P. eickii* Engl. Jahrb. 33: 130 (1904).

Type: Eick 39 (B).

It is probable that we must also include:

TANGANYIKA.—*P. uhehensis* Engl. Jahrb. 27: 380 (1901).

Type: Goetze 720 (B). This specimen has an abnormally large head.

I have no doubt that all these forms represent a single, widespread, variable species. They are united by such characters as the unusually pale, straw-coloured seed hairs (which unfortunately darken with age so that this is unreliable in the herbarium) and the triangular appendage to the anthers.

(a) subsp. *hirta*.

*P. hirta* Klotzsch in Flora, 67 (1845) and Beitrag Fl. Kap.- und Natal, 140 (1846); Meisn. in DC. Prodr. 14: 236 (1856); Medley Wood in Pl. Natal 3: t. 218 (1902); Phillips in F.C. 5: 582 (1913) in part; Bews in Fl. Natal & Zulul. 82 (1921).

Type: Umlaas Riv., Krauss 202 (B, holo.!).

Growing as it does at the extreme southerly limit of the range of the species, this subspecies exhibits reduction in size and is commonly found as a low shrub less than 1 m high, often with numerous ephemeral stems arising from a rootstock. *Stems* only 5 mm thick. *Leaves* as for aggregate species. *Heads* generally solitary and terminal only, 4–5 cm long, bracts 4–5-seriate. *Perianth* 3 cm long of which 8 cm for the base, 10 mm for the tube and 12 mm for the lip. *Style* 3.5 cm long, stigma 6 mm.

A rare plant, found in the Natal Coast belt from Umzinto to Nkandhla on outcrops of Table Mountain Sandstone, and still more rarely on the eastern Transvaal escarpment.

NATAL.—Pietermaritzburg: Table Mt., McClean 165; Sim 19402. Umvoti: Seven Oaks, Beard 727; 772; 883. Umzinto: Dumisa, Fairfield, Bayer 1418. Pine-town: Blackhill, Hesom s.n. Near Umlaas River: Krauss 202. Spring Grange, Platt s.n. Springfield: Moonsamy s.n. Kloof: Dohse Landell and Shepherd 39. Inanda: Medley Wood 577. Nkandhla: Wylie in herb. Medley Wood 8757.

TRANSVAAL.—Lydenburg: Beard 875.



(b) subsp. **glabrescens** Beard, subsp. nov.

*P. hirta* sensu Phillips in F.C. 5: 582 (1913) in part; sensu Burtt-Davy in Fl. Transv. 211 (1926).

Type: Pretoria, Meeuse 9052 (PRE, holo.!).

Frutex ramosus a subspecie *hirta* foliis minoribus demum manifeste glabrescentibus, capitulis majoribus saepe lateralibus et fasciculatis differt.

This subspecies is characterised as follows:—

A divaricate shrub generally about 1 m high, sometimes rather less, sometimes up to 3 m. Branchlets 5–10 mm thick. *Leaves* oblong to oblanceolate, very variable as to size from 12–25 mm in width and 6–12 cm long, (average about  $2 \times 8$  cm), apex obtuse, base attenuate; blade coriaceous, densely pubescent in youth, at length apparently glabrescent but with closely adpressed fine silky hairs, especially on the base of the midrib. *Heads* terminal or lateral, very commonly in groups of two to four or more, 4–6 cm long. *Bracts* 5–8-seriate, often pink in bud, russet to yellow with fine silvery pubescence, much shorter than the flowers. *Perianth* 4–5 cm long of which 10–12 for the base and 15–20 each for the tube and lip: lateral teeth 3 mm, median 2 mm. *Style* 5 cm long, stigma 8 mm.

Flowers in summer.

Locally frequent in the Bankenveld and Sour Bushveld of the Transvaal on sandy flats.

#### SELECTED CITATIONS.

TRANSVAAL.—Middelburg: *Smith* 3470. Belfast: Machadodorp, *Marais* 11. Waterberg: Warmbaths, *Marloth* 3807; Geelhoutkop, *Breyer* 30236. Potgietersrust: *Galpin* 8834. Pretoria: Hammanskraal, *Codd* 7045; Nature Reserve, Meeuse 9052. Rustenburg: *Dyer* and *Verdoorn* 3925. Johannesburg: *Burtt-Davy* 4002. Ventersdorp: Mabaalstad, *Louw* 1900.

13. *P. rubropilosa* Beard, sp. nov.

Type: Pietersburg Dist., Wolkberg, *S. Thompson* 828 in herb. J. S. Beard (PRE, holo.!).

Arbor usque 8 m alta cortice nigro, ramulis glabris, aereis, 1 cm crassis. *Folia* sessilia, obovata, 5 cm lata, 15 cm longa, apice rotundata, inferne angustata; lamina glaberrima, nervis utrinque prominentibus. *Capitulum* 8 cm longum, sive sessile. *Involucris* bracteae 7 seriatæ supra stipitem, subacutæ, extrinsecus dense rubro-pilosae ac margine rubro-ciliatæ, usque 5 cm longæ quam floribus multum breviores. *Calyx* 6 cm longa, inferne glabra, limbo dense albotomentoso, 2 cm longo; limbi dentes 3 mm rubro-cristati. *Stylus* puniceus, 7 cm longus, glaber; stigma 12 mm, filiforme.

Gnarled tree with spreading branches up to 8 m in height and 1 m in diameter (more commonly 5 m high and 25 cm in diameter), bark black, flaky. Flowering branchlets 1 cm thick, glabrous with shiny copper-coloured bark. *Leaves* sessile, confined to previous season's wood, dark green, obovate, 5 cm wide by 15 long, apex rounded, slightly narrowed towards the base: blade leathery, quite glabrous with a transparent margin; midrib red, prominent both sides, secondary veins irregularly reticulate, prominent both sides (with no marginal vein) *in sicco* but indistinct in fresh leaves. *Heads* solitary, terminal, 8–10 cm long and as much in diameter, globose-everted, virtually sessile, opening to 90° at anthesis and thereafter remaining open until the seed is shed. Receptacle convex, 25 mm wide. *Bracts* about 7-seriate, rosy-pink, densely rusty-pilose without and ciliate with tawny hairs 1–2 mm long, the pilosity giving the bracts a bronze metallic sheen; bracts up to 2 cm broad and 4 cm long, much shorter than the flowers, acute to rounded. *Perianth* white with rosy-red



veins on the tube and lip, 6 cm long of which 1.5 cm for the base, 2.5 for the tube and 2 cm for the lip; base and tube glabrous, lip densely white-tomentose on the sides and keel and recurved at the top; lateral teeth 3 mm, median 1 mm tufted with rusty hairs. *Anthers* linear, 12 mm long, with an apical gland. *Style* pinkish, 7 cm long, glabrous, terete; stigma filiform, 12 mm long, passing abruptly into the style. *Ovary* 3 mm long, fruit 1 cm clothed with reddish hairs.

Flowers in spring, (August to October).

This species is named from the unusually thickly pilose nature of the bracts. It is found along the north-eastern Transvaal escarpment, above 6,000 ft., from Lydenburg to the Wolkberg.

TRANSVAAL.—Lydenburg, *Keet* 1123. Mariepskop, *Beard* 865. The Downs, *Rogers* 21964. Wolkberg, *L. C. Thompson* s.n.; *Sheila Thompson* 828 in herb. J. S. Beard; *Schutte* s.n. Drakensberg without precise locality, *Kilpir* N. B. Gard. 1000/31.

#### 14. *P. comptonii* Beard, sp. nov.

Type: Barberton, *Compton* 19781 (KIRST, Holo!).

Arbor ramis glabris 2 cm crassis. *Folia* sessilia, aliquot magna, oblanceolata, 4.5 cm lata, 18 cm longa, glabra margine rubro, nervulis in sicco utrinque prominentibus. *Capitulum* grande, 10 cm longum, sessile. *Involucri* bracteae 6-seriatae, glaberrimae, subvirides, 5 cm longae, quam floribus breviores. *Calyx* alba, glabra praeter lateribus dentibusque limbi dense villosis, 8 cm longa, limbus dentatus 3 cm, dentibus lateralibus 4 mm longis rubido-cristatis. *Stylus* albus, 8 cm longus, glaber. *Stigma* album, filiforme, 12 mm longum.

Gnarled tree up to 5 m high with a short trunk up to 20 cm diameter. Bark very thick and corky and longitudinally fissured. Flowering branchlets unusually stout, 1.5–2 cm thick, glabrous with glossy pale brown bark. *Leaves* sessile, crowded at the end of the branchlets, dark green and fleshy, oblong to oblanceolate, unusually large for this genus, 3–6 cm wide by 12–24 cm long (average about 4.5 × 18 cm), apex obtuse, often faintly retuse at the tip, base broadly attenuate, lamina 2 cm broad just above junction with stem; blade stiff, fleshy, quite glabrous, midrib red below, yellow-green above, prominent both sides, secondary venation inconspicuous in the fresh state, becoming prominent when dry on both sides; margin red, translucent. *Heads* solitary, terminal, 8–10 cm long by 10–15 cm in diameter, virtually sessile, everted, opening to 180° at anthesis and thereafter remaining wide open until the seeds are shed. Receptacle conical, 2.5 cm wide. *Bracts* about 6-seriate, pale green, quite glabrous, with a shiny waxy covering, 2.5 cm wide at their broadest, up to 5 cm long, very much shorter than the flowers, obtuse, very shortly white-ciliate. *Perianth* white, glabrous except on the sides, keel and teeth of the lip which are densely villous, 8 cm long of which 2 cm for the base, 3 for the tube and 3 for the lip which is 5 mm broad; lateral teeth 4 mm long, median tooth 1.5 mm, conspicuously tipped with reddish hairs. *Anthers* linear, 15 mm long, apical gland 1 mm. *Style* white, 8 cm long, glabrous, terete or very slightly flattened, tapering; stigma white, slender, 12 mm long, passing with a slight bend into the style. *Ovary* 3 mm long, fruit 10 mm, clothed with whitish hairs.

Flowering in autumn and winter, (May to July).

This species bears the name of Professor R. H. Compton, its first collector. It is known only from the mountains above Barberton in the eastern Transvaal, along the road from Barberton to Havelock Mine, altitude 4–5,000 ft., in grass on rocky mountain slopes, associating with *P. roupelliae* Meisn. and *P. rhodantha* Hook. f., var. *falcata* Beard.

TRANSVAAL.—Barberton: *Compton* 19781; *Schelte* 4107; *Hamilton* 794 and 809 in herb. J. S. Beard.

15. *P. curvata* N.E. Br. in Kew Bull. 1901, 131; Phillips in F.C. 5: 580 (1913); Burt-Davy in Fl. Transv. 211 (1926).

Type: Barberton, *Galpin* 973 (K, Lecto., NH, GRA, CTM, BOL, iso.!).

A slender tree up to 6 m in height, with long ascending branches. Flowering branchlets 1 cm thick, bark smooth, grey-pink and shortly tomentose in youth, longitudinally wrinkled. *Stem* up to 15 cm diameter, bark black, scaly and fissured. *Leaves* sessile or so long attenuated at the base as to appear petiolate, closely ranked, light green, mostly somewhat falcate, linear-oblongate, 10–15 mm wide by 10–20 cm long (average about  $1.3 \times 15$  cm), apex obtuse, long attenuated to 2–3 mm wide at the base: blade leathery, glabrous; midrib prominent both sides, secondary venation indistinct, irregular; blade with translucent cartilaginous margin. *Heads* solitary, terminal, 6–7 cm long and as much in diameter, globose everted, pedunculate with a short scaly stipes 5 mm long, opening to  $180^\circ$  at maturity and thereafter remaining fully opened till the seed is shed. Receptacle conical, 2 cm wide. *Bracts* about 4-seriate above the stipes, grey-tomentose on the lower half, glabrous above, deep red in colour, 15 mm wide at their broadest, up to 4 cm long, very much shorter than the flowers, obtuse to sub-acute, minutely ciliate. *Perianth* rose-pink, pubescent except on the lower part of the base, and the upper part of the back of the lip, 5 cm long of which 1 cm for the base, 2 cm each for the tube and lip; tube pubescent within; lateral teeth 3 mm long, tomentose except at the glabrous tips, median tooth 2 mm filiform. *Anthers* linear, 15 mm long, with an apical gland. *Style* pink, about 6 cm long, flattened below, trigonous above, glabrous: stigma red, slender, 10 mm long, obtuse, passing with a slight bend into the style. *Ovary* 2 mm long. *Fruit* 1 cm long, and 5 mm thick at top, clothed with long red to yellow-brown hairs.

Flowers in winter, (June to July).

This extraordinary tree, so peculiar in appearance and habitat, confined as it is to a single koppie in the bushveld below Barberton, was first collected by *Galpin* in 1895, his specimen forming the basis of N. E. Brown's description in 1901. It was collected again by Thorncroft in 1919. The locality given in *Galpin's* register is vague, "Kaap River Valley, 2,500–3,000 ft.". However the labels of all the specimens in the South African herbaria, though of the same number and written up in *Galpin's* handwriting, bear in many cases different data as to locality. The one in the Natal Herbarium has "Caledonian" which is a siding five miles north of Barberton and with this direction Dr. P. D. Hamilton was enabled to rediscover the type locality in 1956. The precise spot is a koppie formed by an outcrop of talcose schist, rising from the north bank of the Suidkaap River slightly downstream from Caledonian. As far as is known the species is confined to this single locality, in a bushveld association with *Acacia* spp., *Pavetta edentula*, *Combretum transvaalense*, *C. apiculatum* and *Bolusanthus speciosus*.

TRANSSAAL.—Barberton: *Galpin* 973; *Thorncroft* 1053; *Hamilton* 832; 884 in herb. J. S. Beard.

#### REPUTED HYBRID FORMS.

*P. hirta* X *P. simplex*. A number of plants exist in a mixed population of the parental species near the Catholic Mission, Canema, Seven Oaks, Natal: *Dyer* 4144, *Beard* 773; 774.

*P. gagedi* X *P. rhodantha*. Along road from Barberton to Havelock Mine six miles from the Barberton–Kaapmuiden main road, a single plant: *Meeuse* 10108 (1957). Both parental species present—*Meeuse* 10107, *P. rhodantha*; 10109, *P. gagedi*.

## DOUBTFUL RECORDS.

*P. tenax*, R. Br. Rogers 28291 (PRE), Culvers, Weenen, Natal. As this species has only otherwise been collected in the False Macchia of the Eastern Province, it is supposed that an error in labelling the specimen may have occurred.

*P. grandiflora*, Thunb. Rogers 22298 (PRE), Rustenburg. The locality is thought to be incorrect as in the case of the above.

## ACKNOWLEDGMENTS.

The writer is indebted to the Chief and staff of the Division of Botany, and to Prof. A. W. Bayer and the staff of the Botany Department, University of Natal, for advice, encouragement and assistance; and to the Division of Botany for assistance in the matter of field work.







PLATE I.—*Protea dracomontana* Beard



# The *Albizia* Species of South Africa.

By

L. E. Codd.

Most of the South African *Albizia* species were dealt with by Burtt Davy in his *Flowering Plants and Ferns of Transvaal and Swaziland*, Vol. 2, 1932, but several name changes have rendered it desirable to review them again. The opportunity is also taken to include those species not listed by Burtt Davy. The territory covered by the present review is made up of the Union of South Africa, South West Africa, Swaziland and Basutoland, but excludes Bechuanaland, and is therefore the area to be dealt with by the proposed *Flora of Southern Africa*. Eleven species are recorded as being indigenous in this area, while two exotic species are considered to be sufficiently naturalised to be included in this treatment. One species found in South African gardens, *A. julibrissin* Durazz., is not included because it shows no signs of becoming naturalised. This is not due to lack of opportunity because Sim, in manuscript notes, relates that 100 lbs. of seed of this species were sent to Pondoland and were sown in error for wattle seed, but there is no evidence that any plants have become established.

In addition to the material in the National Herbarium, Pretoria, specimens have been seen from the following Herbaria, whose co-operation is gratefully acknowledged: Bolus, Kirstenbosch, South African Museum, Albany Museum, Natal (Durban), Natal University (Pietermaritzburg) and the Forestry Department, Pretoria. When citing specimens, the abbreviation indicating the Herbarium is given only in cases where the gathering is not represented in the National Herbarium.

Useful assistance and advice concerning certain species with a largely tropical distribution have been freely given by Mr. J. P. M. Brennan of Kew Herbarium, while Mr. D. J. B. Killick, our liaison officer at Kew, has helped by consulting botanical material and literature not available in South Africa. I am also grateful to the Directors of the Zurich University Herbarium and of the East African Herbarium, Nairobi, for the loan of type material.

Durazzini based the genus *Albizia* on *A. julibrissin* Durazz., naming it in honour of "Il sig. Cavalier Filippo degl' Albizzi" since, he claimed, a member of this illustrious family first introduced the species into Tuscany from Constantinople in 1749. Apparently Durazzini considered that two "z's" in the middle of a latinised generic name would not be appropriate because he deliberately spelt the genus with one "z". The name was amended to "Albizzia" when it was taken up by Boivin (1834) and Bentham (1844), and this spelling has been in general use, though Mueller (1872) referred to the original spelling. Since Little (1949) drew attention to his examination of the rare publication containing Durazzini's description, several authors have reverted to the original spelling, so it is unlikely that favourable consideration would now be given to a proposal to conserve the philologically preferable spelling "*Albizia*".

In *Albizia* species the stipules are herbaceous and are shed very early, unlike the African species of the closely related genus *Acacia*, where the stipules usually become hard and thorny. The main diagnostic character between the two genera, however, is to be found in the stamens which, in *Albizia*, are usually longer and are united at the base into a tube. In *Acacia*, the stamens are free or very shortly connate at the base into a shallow cup or irregular perigynous disc.

Useful timber is derived from certain species of *Albizia*, for example, *A. adianthifolia*, *A. versicolor* and *A. suluensis*, though pieces of timber size are rare in South Africa. *A. suluensis* and *A. tanganyicensis* contain a substance which causes irritation to the nose and throat when the wood is worked. The bark of some species is known to have anthelmintic properties and to contain saponins, and such species are used medicinally by various native races. According to Watt and Brandwijk, the anthelmintic action is not due to the saponins, but to other unidentified substances.

### ALBIZIA

*Durazz.* in *Magazz. Toscan.* 3, 4: 11 (1772); *Little*, *Amer. Midland Nat.* 30: 510 (1945); *Lawrence*, *Gentes Herb.* 8: 44 (1949); *Brenan*, *Kew Bull.* 189 (1955); as *Albizzia*, *Benth.* in *Hook. Lond. Journ. Bot.* 3: 84 (1844); *Harv.* in *Fl. Cap.* 2: 284 (1861-62); *Oliv.* in *Fl. Trop. Afr.* 2: 355 (1871); *Bak. f.*, *Leg. Trop. Afr.* 855 (1930); *Burtt Davy*, *Fl. Tvl.* 2: 347 (1932).

*Zygia* P. Br. sensu E. Mey. *Comm. Pl. Afr. Austr.* 165 (1836); *Benth.* in *Hook. Lond. Journ. Bot.* 3: 92 (1844); *Harv.* in *Fl. Cap.* 2: 284 (1861-62).

Trees or shrubs, unarmed. *Leaves* bipinnate usually with a gland on the petiole and often elsewhere on the pinnae; stipules herbaceous, usually early deciduous. *Inflorescence* globose or spicate, pedunculate, arranged in terminal panicles or racemes, or 1-several axillary. *Flowers* usually 5-merous, hermaphrodite or, rarely, some flowers in the inflorescence unisexual. *Calyx* campanulate to tubular, 5-toothed; teeth shorter than the tube. *Corolla* funnel shaped, deeply 5-lobed; lobes shorter than the tube. *Stamens* numerous, much exerted, connate in a tube at the base; tube included or exerted; anthers peltate on the filaments. *Ovary* oblong to lanceolate, subsessile or shortly stipitate; style filiform, usually longer than the stamens; stigma scarcely differentiated. *Pod* oblong to linear, flat, few to several seeded, papyraceous to subcoriaceous, sometimes dehiscent by the separation of the valves. *Seed* flat, ovate to orbicular, compressed; funicle filiform.

#### KEY TO SPECIES.

Staminal tube included within the corolla, or scarcely exerted:

Leaflets not exceeding 4 mm in width:

Inflorescence spicate..... 13. *A. lophantha*.  
Inflorescence globose:

Mature leaves and twigs glabrous; calyx and corolla with a few whitish hairs..... 1. *A. brevifolia*.

Mature leaves and twigs pubescent; calyx and corolla fulvo-tomentose:

Pinnae 15-35 pairs; leaflets 25-42 pairs..... 2. *A. amara* spp. *sericocephala*.

Pinnae 8-15 pairs; leaflets 16-24 pairs..... 3. *A. harveyi*.

Pinnae 2-7 pairs; leaflets 6-14 pairs..... 4. *A. forbesii*.

Leaflets exceeding 4 mm in width:

Mature leaflets persistently tomentose..... 5. *A. versicolor*.

Mature leaflets glabrous or with scattered hairs:

Leaflets 7-18 pairs or, if less, exceeding 2.4 cm in length; branchlets not spine-tipped:

Leaflet margin not crisped; stamens usually exceeding 2 cm in length:

Corolla lobes fulvo-tomentose; pedicels less than 2 mm in length:

Leaflets markedly discolorous; bark grey, not peeling in papery flakes

6. *A. antunesiana*.



Leaflets not markedly discoloured;  
bark pale brown  
to whitish, peeling  
in papery flakes

7. *A. tanganyicensis*.

Corolla lobes glabrous or with a fringe of  
whitish hairs; pedicels  
usually longer than 2  
mm.....

12. *A. lebbeck*.

Leaflet margin crisped; stamens less than 2 cm in  
length.....

8. *A. sulensis*.

Leaflets 2-6 pairs less than 2.5 cm in length; branchlets often  
spine-tipped.....

9. *A. anthelmintica*.

Staminal tube well exerted beyond the corolla:

Leaflets 3-5 pairs..... 10. *A. evansii*.

Leaflets 6-12 pairs..... 11. *A. adianthifolia*.

### INDIGENOUS SPECIES.

1. *A. brevifolia* Schinz in Bull. Herb. Boiss. ser. 2, 2: 945 (1902); Bak. f., Leg. Trop. Afr. 864 (1930).

Type: Mocambique, Zambesi area, Boruma, *Menyharth* 944 (Z, holo.).

*A. rogersii* Burtt Davy, Flora Tvl. 2: xviii and 348 (1932); Codd, Trees and Shrubs, K.N.P. 56 (1951).

Type: Transvaal, Soutpansberg District, Messina, *Moss and Rogers* 66 (PRE, iso.).

*A. parvifolia* Burtt Davy, l.c. xvii and 348 (1932).

Syntypes: Transvaal, Soutpansberg District, near Messina, *Rogers* 19247a (PRE, iso.) and 22118.

Shrub or tree 4-15 m high, usually branching near ground level, bark grey; young parts pubescent, becoming glabrous with age. *Leaves* 8-10 cm long and 4-6 cm wide, sparingly pubescent when young, soon becoming glabrous; petiole 1-2 cm long; pinnae 6-10 pairs; leaflets 10-20 pairs, linear oblong, 3-5 mm long and 1 mm broad, oblique at the base, apex obtuse to rounded, not falcate, midrib nearly central. *Inflorescence* of 8-15 flowers; buds pubescent; peduncle 1.5-3 cm long, sparingly strigose; bracts and bracteoles linear, early deciduous, 4 mm and 1 mm long respectively. *Flowers* creamy white; pedicels 1 mm long. *Calyx* 1-1.5 mm long, 5-toothed, pubescent at first, becoming glabrous or retaining a fringe of hairs. *Corolla* 4.5-5 mm long, 5-lobed; tube glabrous, 2.5-3 mm long; lobes deltoid, 1.5-2 mm long with a tuft of hairs at the apex of each lobe. *Stamens* 1.5-1.8 cm long, united at the base for 3 mm. *Ovary* glabrous, 1.5 mm long, shortly stipitate; style filiform exceeding the stamens in length. *Pod* several seeded, linear to linear-oblong, 12-23 cm long and 2.4-4 cm broad, flat, thin textured, often with transverse striations; margin slightly thickened, straight or indented between the seeds; position of seeds apparent as raised bumps on the valve.

Recorded from Mocambique, Southern Rhodesia, Bechuanaland and the Transvaal.

TRANSVAAL.—Soutpansberg: Messina, *Moss and Rogers* 66; *Pole Evans* 2527; *Gerstner* 5449; near Messina, *Rogers* 19247a; Dongola area, *Codd* 4459; Zoutpan, *Bremekamp and Schweickerdt* 310; *Verdoorn* 601; *O.S.V.* 170; Masekwapoort, *Codd* 8372; 4 miles N.W. of Wyllie's Poort, *Codd* 2999; Mpefu Location, *Smuts* 2053; Vanetzi Poort, *Gerstner* 6055; 6231; Kruger Nat. Park, near Punda Maria, *Lamont* 5; Lebombo Hills, *Lamont* 20. Pilgrims Rest: Kruger Nat. Park, The Gorge, *Codd* 6188; *van der Schijff* 2323. Waterberg: 11 miles S. of Ellisras, *Codd* 8493; 8831. Brits: Farm Welgevonden, *Mogg* 14641; 7 miles N. of Assen, *Codd* 6566. Rustenburg: Onkuil, *van Nieuhuys* 61.

The holotype of *A. brevifolia* was kindly sent to us on loan by the Director of the Botanical Museum, Zurich University, and was compared with an isosytype of *A. parvifolia* present in the National Herbarium, Pretoria. Both are flowering specimens with immature leaves and are similar in all essentials. When taken into consideration with a good range of modern material, the conclusion is unavoidable that only one species is involved. The type of *A. rogersii* is a fruiting twig with mature leaves. Observations made in the type area of *A. rogersii* and *A. parvifolia*, that is, in the northern Transvaal between Messina and Dongola, combined with the examination of flowering and fruiting specimens collected from individual trees, leave no doubt that the two are conspecific. The leaves of the type material of *A. parvifolia* are so immature that the leaflets can scarcely be distinguished; thus the number of leaflets and their dimensions given by Burt Davy cannot be regarded as representative.

The type locality of *A. brevifolia* is Boruma, on the lower reaches of the Zambesi River in Mocambique, and intermediate localities in Southern Rhodesia form a link with the records from the Transvaal. In the last named region the species is almost invariably associated with hot, dry, rocky hillsides, on geological formations such as sandstone, quartzite or granite. Although often found as a small tree branching from near ground level, it is said to grow to 40 feet tall with a spreading, umbrageous crown. Information on herbarium specimens indicates that the wood is hard and durable and is used for axe and pick handles. According to Lamont (formerly a Ranger in the northern part of the Kruger National Park), the bark, being termite resistant, is stripped and used for tying poles of huts. Notes on characters distinguishing *A. brevifolia* from *A. harveyi* will be found in the discussion on the latter species.

2. *A. amara* (Roxb.) Boiv. subsp. *sericocephala* (Benth.) Brenan in Kew Bull. 1955: 190.

Syntypes: Ethiopia, Kotschy 294; Sennaar, Kotschy 244; Abyssinia, Schimper 818, 883.

*A. sericocephala* Benth. in Hook. Lond. Journ. Bot. 3: 91 (1844); Milne-Redhead in Kew Bull. 1934: 301; Brenan and Greenw., Ch. List. For. Trees and Shrubs. Tanganyika, 2: 341 (1949).

*Acacia sericocephala* Fenzl in Flora, 312 (1844), *nomen nudum*.

*Inga sericocephala* A. Rich., Fl. Abyss. 1: 236 (1847).

*Albizia struthiophylla* Milne-Redhead in Kew Bull. 1933: 144.

Type: Northern Rhodesia, Mazabuka, Milne-Redhead 1207 (PRE, iso.).

Tree 4–12 m tall; branchlets persistently pubescent. Leaves 10–18 cm long and 3·5–5 cm wide, fulvo-tomentose when young, rusty to grey hispid when mature; petiole 0·8–1·5 cm long; pinnae 15–35 pairs; leaflets 25–42 pairs, linear oblong, 3–3·5 mm long and 0·5–0·75 mm broad, oblique at the base, apex obtuse to rounded, not falcate; midrib nearly central. Inflorescence of 12–18 flowers; bracts and bracteoles minute, linear, early deciduous; peduncle 1·5–2 cm long; peduncle and buds fulvo-tomentose. Flowers whitish, subsessile. Calyx 1·5–2 mm long, 5-toothed, golden tomentose; teeth rounded. Corolla 4·5–5 mm long, 5-lobed, golden tomentose, especially on the lobes; lobes ovate deltoid, 2–2·5 mm long. Stamens 1·2–1·4 cm long, united at the base for 2–2·5 mm. Ovary glabrous, 2–2·5 mm long, shortly stipitate; style filiform, slightly exceeding the stamens in length. Pod several seeded, linear to linear oblong, 12–28 cm long and 2·8–4 cm wide, flat, thin textured, with occasional transverse striations; margin slightly thickened, straight or occasionally indented between the seeds; position of seeds apparent as raised bumps on the valves.

Recorded from Anglo-Egyptian Sudan and Eritrea, through tropical East Africa and the Rhodesias to Bechuanaland and north-eastern Transvaal.

TRANSVAAL.—Soutpansberg: Nuanetsi Drift, *Smuts* s.n.; Sibasa area, *van Warmelo* 5115/24; 24 miles N.E. of Sibasa, *Codd* 6901; 17 miles E. of Sibasa, *Codd* and *Dyer* 4494; Shingwedzi River, *Forest Officer*, Pietersburg, s.n.; Minga, near Punda Maria, *Gerstner* 6219; Kruger National Park, near Punda Maria, *van der Schijff* 986; between Shangani and Punda Maria, *van der Schijff* 2894.

Baker (1930) places *A. sericocephala* Benth. as a synonym of *A. amara* (Roxb.) Boiv. It was upheld again as a distinct species by Milne-Redhead (1934), but Brenan (1955) takes an intermediate course and gives it the status of a subspecies of *A. amara*. According to the latter author, specimens referable to the subsp. *amara* are also to be found in East Tropical Africa, though this subspecies has its main distribution in Asia. *A. struthiophylla* has been regarded for some time as being hardly separable from *A. sericocephala*, a view confirmed by Brenan, l.c.

Within our region, *A. amara* subsp. *sericocephala* has been found only in the north eastern corner of the Transvaal, on sandy flats, mainly in the area between Sibasa and Punda Maria. This area receives a slightly higher rainfall than the typical lowveld to the south, north and east, where the somewhat similar species *A. harveyi* occurs. It may be readily distinguished from *A. harveyi* by its longer leaves, more numerous pinnae and pinnules, and by the apex of the leaflet not being distinctly acute and curved. In stature it resembles *A. harveyi*, being a small tree usually with a single main trunk and a relatively narrow crown.

3. *A. harveyi* Fourn. in Bull. Soc. Bot. Fr. 12: 399 (1865); Bak. f. Leg. Trop. Afr. 865 (1930); Burt Davy, l.c. 348 (1932); Brenan and Greenw., l.c. 341 (1949); Codd, l.c. 56 (1951).

Type: Bechuanaland, banks of the Chobe, Lake Ngami and adjoining forests. *J. McCabe* (K, holo.).

*A. pallida* Harv. in Fl. Cap. 2: 284 (1861/62), non Fourn.

Type: As above.

*A. hypoleuca* Oliv. in Fl. Trop. Afr. 2: 356 (1871).

Type: As above.

Tree 5–10 m tall, usually with a distinct main trunk; bark grey; branchlets pubescent. Leaves 7–12 cm long and 4–5.5 cm wide; young parts fulvous; rhachis persistently strigose pubescent; petiole 1–2 cm long; pinnae 8–18 pairs; leaflets 12–24 pairs, discolorous, pubescent when young, becoming glabrescent with age, linear oblong, 3–6 mm long and 1–1.5 mm broad, oblique at the base, apex acute, falcate; midrib distinctly nearer the upper margin. Inflorescence of 10–15 flowers; buds fulvo-tomentose; peduncle 1.5–3 cm long, hispid; bracts and bracteoles linear, 3 mm and 1.5 mm long respectively, hispid, persisting to the flowering stage. Flowers creamy white, subsessile. Calyx 2–2.5 mm long, 5-lobed, fulvous; lobes deltoid, 0.5 mm long. Corolla 5–5.5 mm long, 5-lobed, pubescent; tube 3 mm long; lobes ovate, 2–2.5 mm long. Stamens 1.3–1.6 cm long, united at the base for 2.5 mm. Ovary puberulous, 2 mm long, very shortly stipitate; style filiform, exceeding the stamens in length. Pod several seeded, linear to linear-oblong, 6–12 cm long and 1.8–2.8 cm wide, flat, thin textured, sometimes with transverse striations; margin slightly thickened, straight or slightly indented between the seeds; position of seeds apparent as raised bumps on the valve.



Distributed from Tanganyika through Nyasaland and the Rhodesias to the Caprivi Strip, Bechuanaland, Mocambique, Transvaal and into Swaziland.

SOUTH WEST AFRICA.—Caprivi Strip: Katima Mulilo, *West* 3249.

TRANSVAAL.—Soutpansberg: *Smuts* s.n.; Messina, *Pole Evans* 1440; Dongola Reserve, Krematfontein, *Pole Evans* 3526; 5½ miles N. of Alldays, *Codd* 4053; 4460; near Wyllie's Poort, *Pole Evans* 2047; Kruger National Park, Punda Maria, *Lang* in TM 32251; *Codd* 4223; Mabaza, *Lang* in TM 32248. Pietersburg: Blaauwberg, on flats at base of mountain, *Leeman* 51. Waterberg: 20 miles E. of Ellisras, *Acocks* 8820. Letaba: Kruger National Park, Letaba area, *Lang* in TM 30357; 30862; *van der Schijff* 623. Nelspruit: Kruger National Park, near Skukuza Camp, *Letty* 57; 12½ miles N.E. of Malelane, *Codd* 5218; Malelane, *Thorncroft* 3111. Barberton: near Hectorspruit, *Burt Davy* 8004; Komatipoort, *Schlechter* 11875 (GRA); *Rogers* 22246.

SWAZILAND.—Near Makombo, *Miller* S/15.

Vegetative specimens of *A. harveyi* are sometimes confused in the herbarium with *A. brevifolia* but the two may be distinguished by the shape of the apex of the leaflet which, in *A. harveyi*, is acute and distinctly falcate, while in *A. brevifolia* it is obtuse or rounded and almost straight. In ecology the two are distinct as *A. harveyi* is found mainly on the flat, dry bush country of the Limpopo valley and the eastern Transvaal Lowveld, where it is a common constituent of the vegetation of the Kruger National Park.

4. *A. forbesii* *Benth.* in Hook. Lond. Journ. Bot. 3: 92 (1844); Harv. in Fl. Cap. 2: 284 (1861–62); *Benth.* in Trans. Linn. Soc. 30: 568 (1875); *Burt Davy*, l.c. 348 (1932); *Codd*, l.c. 54 (1951).

Type: Mocambique, Delagoa Bay, *Forbes* s.n. (K, holo.).

Tree 8–20 m tall, often branching from near the base with spreading, drooping branches, making an extensive crown; branchlets pubescent. *Leaves* 6–10 cm long and 5–6 cm wide, frequently folded along the midrib, hispid; pinnae 2–7 pairs; leaflets 6–14 pairs, oblong, 5–6 mm long and 2–3 mm broad, oblique at the base, apex obtuse to acute, oblique to slightly falcate, often mucronate; midrib distinctly nearer one margin; margin of leaflet inrolled. *Inflorescence* of 10–15 flowers; buds fulvo-tomentose; peduncle 2–3 cm long, hispid; bracts and bracteoles linear, 3 mm and 1.5 mm respectively, early deciduous. *Flowers* creamy white, sessile. *Calyx* 3–3.5 mm long, 5-toothed, fulvous. *Corolla* 6–7 mm long, 5-lobed, fulvous; tube 4–4.5 mm long, subcylindrical, widening towards the throat; lobes ovate, 2–2.5 mm long. *Stamens* 1.3–1.5 cm long, united at the base for 2.5–3 mm. *Ovary* glabrous, 2–3 mm long, shortly stipitate; style filiform exceeding the stamens in length. *Pod* several seeded, oblong to linear-oblong, 8–15 cm long and 3.5–5 cm broad, flat, fibrous, with marked transverse striations; margin thickened, straight; position of seeds not apparent.

Recorded from the eastern Transvaal lowveld, Mocambique and northern Zululand.

TRANSVAAL.—Soutpansberg: Kruger National Park, near Punda Maria, *Rowland Jones* 29. Nelspruit: Kruger National Park, Lower Sabie Road, *Codd* 5497; 5704; *van der Schijff* 3265; 3412; near Malelane, *van der Schijff* 1417. Barberton: Komatipoort, *Pole Evans* H16861.

NATAL.—Zululand, without locality, *Gerstner* 4943. Ingwavuma: Mangusi Forest, *Gerstner* 4076 (NH); Maputo Forest, *Gerstner* 4115. Ubombo: Schreiber's farm, *Gerstner* 5562; Mkuzi Game Reserve, *Ward* 2641.

This is a distinctive species with a limited distribution. Although not generally common, it is sometimes gregarious, occurring in local groups, especially on or near river banks. Under favourable conditions it grows to a tall tree with a large, spreading, twiggy crown, usually with somewhat drooping branches.



5. *A. versicolor* Welw. ex Oliv. in Fl. Trop. Afr. 2: 359 (1871); Bak. f., l.c. 863 (1930); Burtt Davy, l.c. 348 (1932); Brenan and Greenw., l.c. 343 (1949); Codd, l.c. 57 (1951).

Syntypes: Angola, Golungo Alto and Zenza do Golungo, *Welwitsch*, and Nyasaland, Maravi Country west of Lake Nyasa, *Kirk* (all at BM).

Var. *mossambicensis* Schinz in Bull. Herb. Boiss. ser. 2, 2: 946 (1902); Bak. f., l.c. 863 (1930).

Type: Mocambique, Zambesi area, Boruma, *Menyharth* 77b (Z, holo.).

*A. mossambicensis* Sim, For. Fl. P.E.A. 59, t. 60 (1909).

Type: Mocambique, Umbelusi, *Sim* 6392 (NU, holö!).

Tree 6–18 m tall with a single main trunk and a large, round or spreading crown; bark grey; branchlets persistently tomentose. Leaves 18–30 cm long and 12–24 cm broad; rusty pubescent; petiole 3–6 cm long; pinnae 1–3 pairs; leaflets 3–5 pairs, oblong to obovate-oblong or broadly elliptical, 3–5.5 cm long and 1.5–3 cm broad, oblique at the base, apex rounded to truncate, often mucronulate. Inflorescence 18–25 flowered; peduncle 4–5.5 cm long, fulvo-tomentose. Flowers creamy white, sessile. Calyx 5.5–6.5 mm long, 5-toothed, fulvo-tomentose; teeth deltoid, 1.5 mm long. Corolla 7–8 mm long, 5-lobed, tomentose; tube 3.5–4 mm long; lobes ovate, 3.5–4 mm long. Stamens 2.8–3.5 cm long, united at the base for 3 mm. Ovary puberulous, 3 mm long, subsessile; style filiform, slightly exceeding the stamens in length. Pod several seeded, linear to linear-oblong, 8–22 cm long and 3–5.5 cm wide, flat, thin textured with some transverse striations; margin thickened, straight or slightly indented between seeds; position of seeds apparent as raised bumps on the valves.

Recorded from Uganda southwards to Angola, South West Africa, Bechuanaland, the Rhodesias, Mocambique, Transvaal, Swaziland and Zululand.

SOUTH WEST AFRICA.—Ovamboland: Oshikongo, *Loeb* 20; 431; *Rodin* 2609 (BOL). Okavango: Runtu, *Maguire* 1595; Popa Falls, *Maguire* 1665. Caprivi Strip: *Curson* 940.

TRANSVAAL.—Soutpansberg: Messina, *Pole Evans* 2040; Soutpansberg Range, *Smuts* s.n.; Soutpan, *Galpin* 15128; Elim, *Obermeyer* 564; Makonde, *Westphal* in TM 29123; 4 miles S.E. of Sibasa, *Codd and Dyer* 4491; Kruger National Park, Punda Maria, *Lang* in TM 32301; *Codd and Dyer* 4615; Rowland Jones 14. Pietersburg: *Smuts* s.n.; Letaba: Thabina, *Burtt Davy* 2893; *Swierstra* 2188. Lydenburg: Buffelsvlei, *Codd* 6674. Pilgrims Rest: *Oranje* 4453; Acorn Hoek, *Keet* 1488; Bushbuckridge, *Pritchard* 28; *Acocks* 12894; Lothian, *Forest Dept.* 6836. Nelspruit: *Legat* in Hb. *Burtt Davy* 2830; Kruger National Park, near Pretorius Kop, *Codd* 5694; Rowland Jones s.n.; van der Schijff 151; 431; 727. Barberton: *C. A. Smith* 7072; Malelane, *Pole Evans* H 15771; Queens River Valley, *Galpin* 651; Sheba Valley, *Thorncroft* 3019.

SWAZILAND.—Ingwavuma River, *West* 2105.

NATAL.—Zululand, without locality: *Wylie* 8805; *Boocock* 4; *Gerstner* 5086. Ubombo: Otobotini, *McClellan* in NH 18473 (NH). Hlabisa: *Gerstner* 2944 (NH); Dukuduku Reserve, *Stephens* 97 (NH); Hluhluwe Game Reserve, *Ward* 1861 (NH); van Zinderen Bakker 111 (NH); Bayer in NU 17113 (NU). Lower Umfolosi: Near Ngogodo Siding, *Acocks* 12976; Umhlatuzi Valley, *Lawn* 2118a (NH); Entonjaneni: Near Melmoth Road, *Lawn* 1392 (NH). Eshowe: Between Eshowe and Nkandhla, *Pole Evans* 3622. Mtunzini: Gingindhlovu, *Wylie* in NH 9243 (NH); 4 miles N. of Gingindhlovu, *Lawn* 1864 (NH); Amatikulu, *Wood* 7589.

The type of var. *inossambicensis* Schinz has not been seen. The slight deviations in corolla length and pubescence do not appear to justify its separation even as a variety, nor does an examination of a good range of modern material indicate that this variable species should be split up into groups of minor rank. The type of *A. mossambicensis* Sim is cited as No. 6392. The holotype is in the Natal University Herbarium and was sent on loan by Professor A. W. Bayer. It is actually annotated by Sim as *A. umbelusiensis* (sic), but obviously agrees with his description and plate of *A. mossambicensis* and not with his published *A. umbelusiensis* (see notes under *A. anthelmintica* and *A. evansii*). In all respects the type of *A. inossambicensis* falls within the range of variation accepted for *A. versicolor*.

*A. versicolor* grows to an attractive large tree with a round crown of graceful foliage. A useful timber is obtained from the tree and is known commercially in South Africa as Umvangaas. This is an unfortunate choice as it is the name used in the Swazi and Shangaan languages for the Kiaat (*Pterocarpus angolensis*) which produces a very similar timber. The Swazi name for *A. versicolor* is siVangatsane, or "Little Kiaat". Sim unaccountably states that its timber is useless. Brenan and Greenway, in addition to recording that the timber is used, state that the natives make a soapy substance from the roots and that the roots are employed as an anthelmintic and also as a purgative and enema.

6. *A. antunesiana* Harms in Engl. Bot. Jahrb. 30: 75 (1901); Bak. f., l.c. 861 (1930); Brenan and Greenw., l.c. 342 (1949).

Syntypes: Angola, Huilla, *Antunes* 330, and Nyasaland, Unyika, *Goetze* 1372.

Tree 3–12 m tall; bark grey, rough; young parts pubescent, becoming glabrous with age. *Leaves* 12–25 cm long, and 10–20 cm wide, sparingly pubescent when young, soon becoming glabrous; petiole 4–6 cm long; pinnae 1–3 pairs; leaflets 5–9 pairs, ovate-oblong to trapeziform, 2.5–6 cm long and 0.8–2.8 cm broad, more or less coriaceous, discolorous, oblique at the base, apex rounded. *Inflorescence* of 15–20 flowers, the central flower usually larger than the rest; buds rusty pubescent; peduncle 4–5 cm long, rusty pubescent; bracts and bracteoles small, linear, early deciduous. *Flowers* creamy white; pedicel up to 1 mm long; central flower larger and purely male. *Calyx* 4–5.5 mm long, 5-toothed, narrowing to the base, rusty pubescent. *Corolla* 7–8 mm long, 5-lobed, rusty pubescent, paler than the calyx; tube 3.5–4 mm long; lobes 3.5–4 mm long, ovate oblong, margin inrolled. *Stamens* 2.4–2.8 cm long, united at the base for 4–5 mm. *Ovary* glabrous, 2 mm long, shortly stipitate; style filiform, shorter than the stamens. *Pod* several seeded, linear oblong, 11–16 cm long and 2.5–4 cm broad, flat, thintextured; margin slightly thickened, scarcely indented between the seeds; position of seeds apparent as bumps on the valve.

Recorded from the Belgian Congo, Tanganyika, the Rhodesias, Mocambique, Angola and northern South West Africa.

SOUTH WEST AFRICA.—Okavango: *de Winter and Wiss* 4394. Caprivi Strip: opposite Andara, *de Winter and Marais* 4816.

*A. antunesiana* is closely related to *A. coriaria* Welw. In the absence of authentic material of either species in South African herbaria, I accept the opinion of Mr. D. J. B. Killick, who considers that the two are distinct. He states that *A. antunesiana* has longer leaflets which are more oblique at the base, while the leaf rhachis is always glabrous. *A. coriaria* sometimes has completely glabrous leaflets, but the rhachis always shows some pubescence.

7. *A. tanganyicensis* Bak. f. in Journ. Bot. 67: 199 (1929); Leg. Trop. Afr. 862 (1930); Brenan and Greenw., l.c. 342 (1949).

Type: Tanganyika Territory, Kondowe District, Simbo Hills, *B. D. Burt* 716 (K, hol., EA, iso.!).

*A. rhodesica* Burt Davy, Fl. Tvl. 2: xviii and 348 (1932); Codd, l.c. 56 (1951).

Syntypes: Southern Rhodesia, Matopos, *Galpin* 7082 (PRE, isosyn.) and Victoria Falls, *Allen* 174; *Rogers* 5319.

*A. lebbek* var. *australis* Burt Davy in Burt Davy and Hoyle, Ch. List Trees and Shrubs Nyasaland Prot. 53 (1936), *nomen nudum*.

Tree 3–8 m tall, sparingly branched; branches ascending; bark smooth, white to light brown, peeling in broad, papery strips; twigs sparingly pubescent, usually becoming glabrous or nearly so. *Leaves* 25–40 cm long and 20–30 cm broad, sparingly pubescent, especially when young; petiole 5–10 cm long; pinnae 2–5 pairs; leaflets 5–12 pairs, oblong, broadly elliptical to ovate oblong, 2–4 cm long and 1–2.2 cm broad, oblique at the base, apex rounded to obtuse. *Inflorescence* of 20–25 flowers; peduncle 3–4 cm long; peduncle and buds rusty hispid; bracts and bracteoles small, linear, early deciduous. *Flowers* creamy white, subsessile. *Calyx* 4.5–5.5 mm long, 5-lobed, fulvous; lobes ovate-deltoid, 1.5–2 mm long. *Corolla* 7–9 mm long, 5-lobed; tube usually pubescent, 4–5 mm long; lobes ovate to ovate-lanceolate, 3–3.5 mm long, fulvo-tomentose, especially towards the apex. *Stamens* 2.5–3 cm long, united at the base for about 4 mm. *Ovary* glabrous, 3 mm long, shortly stipitate; style filiform, exceeding the stamens in length. *Pod* several seeded, flat, semi-woody, smooth, linear to linear-oblong, 15–25 cm long and 3–5 cm broad, light brown; margin scarcely thickened; position of seeds usually not visible through valves.

Recorded from Tanganyika, Nyasaland, Rhodesia and the Transvaal.

TRANSVAAL.—Soutpansberg: *Menne* s.n.; Kruger National Park, near Punda Maria, *Lamont* s.n.; *Codd and Dyer* 4549. Waterberg: Near Nylstroom, *Pole Evans* H19679; *Codd* 5601; *Repton* 3472; *Prosser* 1722; 19 miles E. of Vaalwater, *Codd* 986; Leopards Kloof, Hartebeestelaagte, *Galpin* 13391; Rooiberg, *Pole Evans* s.n.; hills near Warmbaths, *Burt Davy* 2183; *Bolus* 11868; *Gerstner* 5278; *Story* 1522.

The probability that *A. rhodesica* would prove to be a synonym of *A. tanganyicensis* was recognised by Mr. B. de Winter while at Kew Herbarium as our liaison officer. This view was supported after seeing an isotype of *A. tanganyicensis* kindly sent to us on loan from the East African Herbarium, Nairobi, and comparing it with material in the National Herbarium.

The name *A. lebbek* var. *australis* is listed by Burt Davy and Hoyle without description or citation of specimens. A clue to its identity is provided by the fact that several sheets in the National Herbarium, Pretoria, are annotated by Burt Davy with this name, including *Galpin* 7082, one of the syntypes of his *A. rhodesica*.

There has been some confusion in the past between *A. tanganyicensis* Bak. f. and *A. lebbek* (L.) Benth., but the two are clearly distinct. Vegetative specimens of the two are very similar, though *A. tanganyicensis* has more closely placed and more numerous leaflets (5–12 pairs), as against 3–9 pairs of leaflets for *A. lebbek*. In *A. tanganyicensis* the individual flowers are subsessile, the calyx is relatively long (4.5–5.5 mm) and is 5-lobed, with a marked golden brown tomentum, especially towards the apex, as well as on the lobes of the corolla. In *A. lebbek* the flowers have pedicels 2–3.5 mm long, the calyx is 4–4.5 mm long, is shortly 5-toothed, with a short, pale brown tomentum, while the corolla is almost glabrous with a few whitish hairs on the lobes. There are other differences, including a marked distinction in ecology and habit. *A. tanganyicensis* is a small deciduous tree inhabiting rock formations with



an acid reaction, such as granite or quartzite. It is sometimes sparingly branched near the base, with few, ascending or crooked branches, forming a sparse canopy. The most striking feature, however, is the bark, which is thin and light brown in colour, peeling off in broad, papery flakes, leaving a white smooth surface. It has no timber value and farmers in the Transvaal have remarked that, when the wood is worked, the dust is a strong irritant to the nose and throat, so that it is locally known as "sneeze-wood".

8. *A. suluensis* Gerstner in Journ. S. Afr. Bot. 13: 62 (1947).

Lectotype: Natal, Melmoth District, 2 miles west of Dundulu Store, Gerstner 4337 (PRE).

Tree 5–15 m tall with a round or spreading crown; bark grey, fissured; young twigs usually pubescent, soon becoming glabrous. Leaves 13–20 cm long and equally broad; petiole 2–5 cm long; pinnae 2–4 pairs; leaflets 5–9 pairs, glabrous to sparingly pubescent, especially on the petiolule, dark green above, underside paler, broadly elliptical to oblong or obovate, 2–2.5 cm long and 1–1.5 cm broad, oblique at the base, apex rounded to truncate, mucronate; margin crisped. Inflorescence of 20–25 flowers; peduncle 3–4 cm long; peduncle and buds fulvo-tomentose. Flowers whitish, subsessile. Calyx 5-toothed, 2.5–3.5 mm long, fulvo-tomentose; teeth rounded. Corolla 5–6 mm long, 5-lobed, fulvo-tomentose; tube 3–3.5 mm long; lobes lanceolate, 3 mm long. Stamens 1.3–1.6 cm long, united at the base for 5–6 mm. Ovary glabrous, 2–3 mm long, shortly stipitate; style filiform, equal to the stamens in length. Pod several seeded, linear to linear-oblong, 8–16 cm long and 1.4–2.6 cm broad, flat, light brown, thin textured with occasional transverse striations; margin slightly thickened, straight or indented between the seeds; position of seeds apparent as raised bumps on the valves.

Distribution confined to northern Zululand.

NATAL.—Hlabisa: Gerstner 1714 (NBG); 1730 (NBG); 4601 (NH); 6440; 6440a (NH); 6440b (NH); Nhlwati, F. Bayer 64; Gerstner 730; Dukumbane, Gerstner 714; Gwegwede River, Gerstner 6261 (BOL); Mtadhlwana Hill, F. Bayer 14/46; 4 miles N. of Hlabisa, Codd 9611; Hluhluwe Game Reserve, Ward 2829 (NH). Melmoth: 2 miles W. of Dundulu Store, Gerstner 4337, (PRE, lecto.).

In choosing one of the National Herbarium specimens as the lectotype, I was influenced by the fact that the preliminary examination leading to the recognition of this as an undescribed species was carried out by Miss I. C. Verdoorn, who had before her a good range of material collected by the Rev. Fr. Gerstner and Mr. F. Bayer, including specimens in better condition than those cited with the published description. In the selection of a lectotype, however, one is limited to the material cited by the author. Of the syntypes listed by Gerstner, two are represented in the National Herbarium, namely, Gerstner 4337 (flowering) and Bayer 64 (fruiting). Although he cites his No. 4601 as being present in PRE, this does not appear to be the case. Because flowers and leaflets are the most diagnostic characters of the species, Gerstner 4337 is chosen as the lectotype. The leaf illustrated with Gerstner's type description is obviously from his No. 4601, which is an immature specimen with leaflets mainly acute. This is not representative of mature specimens, in which the leaflets are rounded to truncate at the apex, with the margins distinctly crisped. The drawing of the flower also conveys the wrong impression through showing the calyx distinctly lobed when in fact it is very shortly toothed.

*A. suluensis* is a graceful tree with a round crown, bearing some resemblance to *A. lebbeck* but can readily be distinguished from that species by the crisped margin of the leaflet, by the golden tomentum of the calyx and corolla and by several other features. It appears to be endemic in northern Zululand, having been collected only from the Hlabisa and Melmoth Districts.



Gerstner records that the natives pound the bark with water, producing a foaming mixture which is used as a powerful enema. The timber is said to be hard and durable with an attractive grain, suitable for furniture. It is also stated that the sawdust produced while working the timber is somewhat irritant and causes sneezing.

9. *A. anthelmintica* (A. Rich.) A. Brongn. in Bull. Soc. Bot. Fr. 7: 902 (1860); Oliv. in Fl. Trop. Afr. 2: 357 (1871); Benth. in Trans. Linn. Soc. 30: 564 (1875); Marloth, Fl. S. Afr. II, 1: t. 29 (1925); Bak. f., l.c. 859 (1930); Brenan and Greenw., l.c. 341 (1949); Codd, l.c. 53 (1951).

Type: Abyssinia, near Add'erbati, *Quartin Dillon*.

Var. *australis* Bak. f., l.c. 859 (1930).

Type: South West Africa, Okahandja, *Dinter* 269 (K, holo., PRE, iso.).

Var. *pubescens* Burtt Davy, l.c. xvii (1932).

Syntypes: Transvaal, Soutpansberg District, Waterpoort, *Rogers* 19347 (PRE, isosyn.) and *Rogers* 21504 (PRE, isosyn.).

*Besenna anthelmintica* A. Rich., Fl. Abyss. 1: 253 (1847).

*Acacia marlothii* Engl. in Engl. Bot. Jahrb. 10: 19 (1889).

Type: South West Africa, near Otjimbingwe, *Marloth* 1317 (B, holo., destroyed; PRE, iso.).

*Albizzia umbalusiana* Sim, For. Fl. P.E.A. 59, t. 55A (1909).

Type: Mocambique, Umbeluzi, *Sim* 6200 (apparently no material extant).

Shrub or small tree 2–10 m tall; branchlets twiggy, usually with lenticular bark, often forming abbreviated, spine-tipped shoots; young twigs usually sparingly pubescent, soon becoming glabrous. Leaves 6–8 cm long and 5–6 cm broad; rachis glabrous to sparingly hispidulous; petiole 0.5–2 cm long; pinnae 2–4 pairs; leaflets 2–5 pairs, the uppermost usually the largest, glabrous above, glabrous or sparingly pubescent on the nerves below, obovate, broadly elliptical to subrotundate or ovate, 0.8–2.5 cm long and 0.5–1.8 cm broad, oblique at the base, apex obtuse, mucronulate. Inflorescence of 15–25 flowers; peduncle 1.4–2 cm long, often sparingly pubescent; bracts and bracteoles small, early deciduous. Flowers white to cream; pedicels 1–2.5 mm long. Calyx 3–4.5 mm long, 5-toothed, deeply cleft on one side, usually glabrous except for occasionally a tuft of white hairs at the apex of each tooth. Corolla 6–9 mm long, 5-lobed, glabrous except for a tuft of white hairs at the apex of each lobe; tube 3–5 mm long; lobes ovate-lanceolate, 3–4 mm long. Stamens 2.3–2.8 cm long, united at the base for 3–4 mm. Ovary glabrous, about 3 mm long, shortly stipitate; style filiform, exceeding the stamens in length. Pod several seeded, linear to linear-oblong, 8–12 cm long and 2–2.5 cm broad, flat, membranous, straw coloured to light brown with occasional transverse striations; margin slightly thickened, straight or indented between the seeds; position of seeds apparent as raised bumps on the valves.

Recorded from Abyssinia, through tropical East Africa and the Rhodesias to Angola, South West Africa, Bechuanaland, Mocambique, Transvaal and Natal.

SOUTH WEST AFRICA.—Ovamboland: near Oshikanga, *Rodin* 2673. Okavango: Runtu, *Maguire* 1615 (NBG). Grootfontein: *Watt and Brandwijk* 1443; Tsumeb, *Basson* 15; Schaap River Hills, *Keet* 1504; 20 miles S. of Osiri, *Liebenberg* 4682. Otjiwarongo: Waterberg, *Liebenberg* 4774. Okahandja: *Dinter* 269 (PRE, SAM, GRA); *Bradfield* 452. Gobabis: *Liebenberg* 4628. Windhoek: *Dinter* s.n.; *Keet* 1674; *Codd* 5793; *Otjiseva, Wiss and Kinges* 739. Rehoboth: *Buellspoor, Srey* 2187. Maltahohe: *Kleinfontein, Marloth* 5052. Keetmanshoop: *Rogers* s.n. (GRA); *Gellap Ost, Acocks* 15608.

TRANSVAAL.—Soutpansberg: Dongola area, *Pole Evans* 3534; *Codd* 4331; near Messina, *Rogers* 19347; *Pole Evans* H18897; *Gerstner* 5453; Waterpoort, *Rogers* 21504; *Gerstner* 5718; Masekwapoort, *Gerstner* 5953; Sibasa area, *Gerstner* 6213; Kruger National Park, Makuleka, *Lang* in TM 32263; Pafuri, *van der Schijff* 642. Pietersburg: *Smuts* s.n.; Leipzig Mission, Blaauwberg, *Leipolt* 3; near Malipsdrift, *Erens* s.n.; *Repton* 699. Waterberg: 30 miles N.W. of Vaalwater, *Smuts* 361. Rustenburg: near Matlabas, *Acocks* 8802. Lydenburg: *Barnard* 49a; 49b; 4 miles N. of Buffelsvlei, *Codd* 6675. Pilgrims Rest: Kruger National Park; Sand River, *van der Schijff* 775. Nelspruit: Kruger National Park, near Skukuza, *Lang* in TM 30866; *Letty* 67; *Codd* 5701; *van der Schijff* 747; 783. Barberton: near Louws Creek, *Acocks* 12879; *Codd* 1040.

NATAL.—Zululand, without locality, *Gerstner* 4944; 5088. Ingwavuma: *Gerstner* 3767 (NH); near Pongola, *West* 2093 (NH); Otobotini, *Gerstner* 3431 (NH). Ubombo: *Mkuzi*, *Galpin* 13691. Hlabisa: Hluhluwe Game Reserve, *Ward* 1440 (NU). Lower Umfolosi: near Umhlatuzi River, *Gerstner* 6441 (NH).

In South Africa and in drier parts of the tropics, *A. anthelmintica* is a small tree or shrub up to about 15 feet tall. According to the Flora of Tropical Africa, it may reach the stature of a large tree from the trunks of which native canoes are made, but this statement requires confirmation. The southern form has been separated variatally by both Baker fil. and Burt Davy. There seems little justification for this course, a view also expressed by Mr. Brenan and Mr. Killick after the examination of a wide range of specimens, including type material. Specimens matching the southern form can be found from north tropical Africa, while pubescence is not restricted to the South African specimens. Dr. P. J. Greenway of Nairobi informs me that he knows the species in the field almost throughout its whole range from the Kruger National Park to the Kenya—Ethiopian boundary and can see no evidence to support the separation of a variety.

The holotype of *Acacia marlothii* Engl., *Marloth* 1317, presumed to have been in Berlin-Dahlem Herbarium, appears to have been destroyed, but a specimen of this number is in the National Herbarium, Pretoria. It is a sterile twig but is unmistakably conspecific with *Albizia anthelmintica*.

There is some evidence that Sim based his *A. umbalusiana* on a mixture. The flowering twig with spine-tipped branchlets illustrated on Plate 55A of his Forest Flora of Portuguese East Africa would pass as *A. anthelmintica*, though the leaf and pod show a closer resemblance to *A. evansii*. No material of the type, Sim 6200, has been traced. The greater part of Sim's phanerogamic collection is in the Natal University Herbarium, but No. 6200 is not represented. Two specimens have been annotated by him with the name *A. umbelusiana* (sic). One of these is No. 6392, the type of *A. mossambicensis* Sim (see note under *A. versicolor*); the other, No. 23118, a fruiting specimen, is identifiable as *A. evansii* Burt Davy, a species with very different flowers from those described and illustrated as *A. umbalusiana*. It seems probable that the leaf and pod of Plate 55A were drawn from this specimen, in which case the flowering twig with spine-tipped branchlets (excluding the leaf) no doubt corresponds to the missing type, No. 6200. It may be noted that Sim also lists *A. anthelmintica*, but gives the description in inverted commas after Dr. Meller, indicating that he was not familiar with the species.

The anthelmintic properties of the roots of this species are recognised by a number of native tribes. Watt and Brandwijk report the presence of sapogenins in the roots but state that these substances are not responsible for the anthelmintic action. Tests with pollen carried out by the Division of Veterinary Services, Onderstepoort, showed that it acts as an irritant to the eyes.

10. *A. evansii* Burt Davy, Fl. Tvl. 2: xvii and 349 (1932). Codd, l.c. 54 (1951).

Type: Transvaal, Nelspruit District, Sabie Game Reserve, *Pole Evans* H16921 (K, holo.).

*Shrub* or small tree 4–8 m tall, usually branching freely from the base with many ascending branches; branchlets pubescent, not forming abbreviated spine-tipped shoots. *Leaves* 5–8 cm long and 4–6 cm broad; petiole 0.8–2 cm long; petiole and rhachis hispidulous; pinnae 2–4 pairs; leaflets 2–5 pairs, obovate to trapeziform-elliptical, 1–2 cm long and 0.5–1 cm broad, upper surface dark green with a few scattered hairs, lower surface paler, hispidulous; base cuneate, usually oblique, apex obtuse, often mucronulate. *Inflorescence* 6–15 flowered; peduncle 0.8–1.5 cm long, hispidulous; bracts and bracteoles minute, early deciduous. *Flowers* whitish, tinged with red; pedicels 1.5 mm long. *Calyx* 1–1.5 mm long, cup-shaped, obscurely 5-toothed, puberulous. *Corolla* 6–7 mm long, 5-lobed, glabrous or sparsely pubescent on the lobes; tube subcylindrical, widening slightly towards the throat, 3.5–4 mm long; lobes 2.5–3 mm long, ovate-lanceolate, cucullate. *Stamens* 1.6–1.8 cm long, united in a narrow tube for 1.2–1.3 cm. *Ovary* glabrous, 2.5 mm long, shortly stipitate; style filiform, exceeding the anthers by 3–5 mm. *Pod* several seeded, linear-oblong, 6–13 cm long and 1.4–2 cm broad, flat, semi-woody, smooth, yellow brown; margin very slightly thickened, usually straight; position of seeds not apparent through the valves.

Recorded from the north-eastern and eastern Transvaal, southern Mocambique and northern Zululand.

TRANSVAAL.—Soutpansberg: Kruger National Park, 2 miles S. of Punda Maria, Codd 5990. Pilgrims Rest: 15 miles S. of Satara, Codd 4296; 20 miles N.E. of Skukuza, Codd 5592. Nelspruit: Kruger National Park, 16½ miles E. of Skukuza, Codd 5706; 5½ miles S.W. of Lower Sabie Camp, Codd 5708.

NATAL.—Ingwavuma: Gerstner 3734; Ndumu Game Reserve, Gerstner 3440; 3993; Ward 2037.

Attention has been drawn (page 78) to the possibility that the description and illustration of *A. umbalusiana* Sim are drawn from the two species *A. anthelmintica* and *A. evansii* and that possibly Sim 23118 is the basis of the leaf and pod of his Plate 55A. Sim also records the native name Nala for his species and this is the Shangaan name for *A. evansii* encountered in the Kruger National Park. However, the description of the flowers of *A. umbalusiana* could not apply to *A. evansii*.

There is a superficial resemblance between the leaves of *A. anthelmintica* and of *A. evansii*, but the leaflets of the latter are hispidulous, especially on the under surface, while those of *A. anthelmintica* are glabrous or with a few scattered hairs on the nerves, and only very rarely hispidulous in some South West African specimens. *A. evansii* is closely related to *A. petersiana* Bolle but the leaflets of the latter species are more numerous and glabrous, while the corolla and stamens are longer. The habit of *A. petersiana* is not known, but *A. evansii* has a very characteristic appearance, unlike any other South African species. It branches freely from near ground level, forming numerous ascending branches 12–25 feet tall (see Trees and Shrubs of the Kruger National Park, Fig. 47). Although never very common, it is sometimes locally gregarious on brakish, sandy flats as, for example, near the Lion Pan in the Kruger National Park.

11. *A. adianthifolia* (Schumach.) W. F. Wight in U.S. Dept. Agr. Bull. 137: 12 (1909); Brenan in Kew Bull. 1952: 520.

Type: Gold Coast, Bliguissu, Thonning s.n. (Hb. Haun., Univ. Bot. Mus., Copenhagen, holo.).

*Mimosa adianthifolia* Schumach. in Schumach. et Thonn., Beskrif. Guin. Pl. 322 (1827).



*Zygia fastigiata* E. Mey. Comm. Pl. Afr. Austr. 165 (1836); Benth. in Hook. Lond. Journ. Bot. 3: 93 (1844); Harv. in Fl. Cap. 2: 285 (1861-62).

Syntypes: Natal, between Umzimkulu and Umkomaas, Drege, and Port Natal, Drege.

*A. fastigiata* (E. Mey.) Oliv. in Fl. Trop. Afr. 2: 361 (1871); Benth. in Trans. Linn. Soc. 30: 570 (1875), *pro parte*; Wood and Evans, Natal Pl. 1: 24, t. 27 (1898); Sim, For. Fl. Cape Col. 213, t. 62 (1907); Sim, For. Fl. P.E.A. 59, t. 58 (1909); Marloth, Fl. S. Afr. II, 1: t. 30 (1925).

*A. gummifera* non (Gmel.) C.A.Sm., C.A.Sm. in Kew Bull. 218 (1930), *pro parte*; Burt Davy, l.c. 2: 349 (1932); Henkel, Woody Pl. Natal and Zul. 236 (1934); Codd, l.c. 55 (1951).

Tree 7-15 m tall with a flat, spreading crown; bark grey; young twigs rusty pubescent. Leaves 12-22 cm and 8-12 cm broad; petiole 3-4 cm long; petiole and rhachis rusty pubescent; pinnae 4-7 pairs; leaflets 6-12 pairs, trapeziform, 1-1.6 cm long and 5-8 mm broad, sparingly hispidulous and dark green above, hispidulous and paler below; midrib diagonal. Inflorescence 15-25 flowered; peduncles 2.5-6 cm long, fulvous; bracts and bracteoles minute, early deciduous. Flowers whitish, shortly pedicellate, of two kinds; outer flowers hermaphrodite, with a few larger male flowers at the centre. Calyx 4.5-5.5 mm long, 5-toothed, fulvo-tomentose. Corolla 8-10 mm long, 5-lobed, grey pubescent; tube subcylindrical, widening towards the mouth, 6-7 mm long; lobes lanceolate-oblong, 2-3 mm long, apex cucullate. Stamens 2.5-3.2 cm long, united into a narrow tube for 1.8-2.6 cm. Ovary glabrous, 2.5 mm long, subsessile; style filiform, exceeding the stamens. Pod several seeded, linear to linear oblong, 11-16 cm long and 2.3-2.6 cm broad, flat, thin textured, pubescent, rugose, pale brown; margin thickened, straight or wavy; position of seeds apparent as bumps on the valves.

Distributed from Senegal to Abyssinia and, southwards, through east Tropical Africa to Rhodesia, Mocambique, Transvaal, Natal and to Port St. Johns in the Cape Province.

TRANSVAAL.—Soutpansberg: Tshakoma, Obermeyer 975; Shewass, Legat in TM 6259; Makonde, Westphal 5; Curson and Irvine 78; Pepeti Falls, Curson and Irvine 97; Kruger National Park, near Punda Maria, Lamont 43; Codd 6529; van der Schijff 3784.

NATAL.—Without locality, Mrs. Saunders s.n. (BOL); Gerrard and McKen 397 (NH). Zululand: Bazwana, Gerstner 3725 (NH). Ingwavuma: Mangazi Forest, Maputa, Bayer 753. Hlabisa: St. Lucia Bay, Pole Evans 3646; near Hluhluwe Game Reserve, Ward 2627. Mtunzini: Ngoye Forest, Schmidt in For. Dept. Herb. 1445. Eshowe: Forest adjoining Eshowe, Codd 1864. Mapumulo: Umhlali, Repton 1838. Inanda: near Umzinyati Falls, McClean and Ogilvie in NH 28868. Durban: Medley Wood 6135. Pinetown: Amanzimtoti, Gerstner in NH 22080 (NH). Umzinto: Dumisa, Rudatis 681; Umdoni Park, Smuts 2340. Port Shepstone: 2½ miles W. of Southbroom, Marais 1147.

CAPE PROVINCE.—Lusikisiki: 2½ miles N. of Embotyi, Codd 9740.

The difficult problem of species limits and synonymy in the *A. gummifera*—*A. adianthifolia*—*A. zygia* complex has been dealt with by Brenan in Kew Bull. 1952: 520, and his conclusions are followed here.

*A. adianthifolia* is a conspicuous tree of the coastal forests of Natal, with its spreading, flat crown of graceful foliage. Sim, in his Forest Flora of the Cape of Good Hope, states that the wood is fine grained, rather soft and susceptible to borer.



## EXOTIC SPECIES.

12. *A. lebbeck* (L.) Benth. in Journ. Bot. Lond. 3: 87 (1844) (as "*A. lebbeck*"); Brenan and Greenw., l.c. 342 (1949).

Type: Linnaean Herbarium, No. 1228/16.

*Mimosa lebbeck* L., Sp. Pl. ed. 1: 516 (1753).

*M. lebbeck* Forsk., Fl. Aegypt. Arab. 177 (1775).

*Acacia lebbeck* (L.) Willd., Sp. Pl. 4: 1066 (1806); DC., Prodr. 2: 466 (1825).

Tree 8–15 m tall with a large round crown; bark grey, fissured; branchlets glabrous to tomentose. Leaves 15–35 cm long and 12–30 cm broad; petiole 5–8 cm long; petiole and rachis pubescent to glabrescent; pinnae 2–4 pairs; leaflets 5–9 pairs, sparingly hispidulous to glabrous, paler below, oblong to broadly elliptical, 2·5–4·4 cm long and 1–2·4 cm broad, oblique at the base, apex rounded, often emarginate; margin not crisped. Inflorescences 1–3 in axils of terminal leaves, each of 20–25 flowers; peduncle 4–6 cm long; peduncle and buds brownish tomentose. Flowers white; pedicels 2–2·5 mm long. Calyx subcampanulate, 4–4·5 mm long, 5-toothed, grey-brown tomentose. Corolla 6–8 mm long, 5-lobed, almost completely glabrous below with patches of whitish tomentum towards the apex; tube subcylindrical, 4–5·5 mm long; lobes ovate-lanceolate 2–3·5 mm long. Stamens 2–2·5 cm long, united at the base for 5–5·5 mm. Ovary glabrous, 2 mm long; style filiform, exceeding the stamens. Pod several seeded, linear to linear-oblong, 12–20 cm long and 3·5–4·5 cm broad, flat, thin textured, light to dark brown; margin thickened, usually straight; position of seeds visible as raised bumps in the valve.

A native of tropical Asia and, probably, tropical Africa, widely cultivated in the tropics. Cultivated and semi-naturalised along the north coast of Natal. According to Forskahl, the specific name is derived from the Arabian name Labach for the tree.

TRANSVAAL.—Pretoria: Meyer s.n.

NATAL.—Mtunzini: Lawn 2118; Gingindhlovu, Lawn 1863 (NH); valley near Gingindhlovu, Lawn (NH). Inanda: 2 miles S. of Verulam, Codd 9653.

*A. lebbeck* is growing in the Botanic Gardens, Durban, and the specimens collected from the coastal areas of Natal and Zululand are from trees that are very likely cultivated or semi-naturalised. The species is included in this treatment because it is sometimes confused in the herbarium with *A. tanganyicensis* and *A. suluiensis*. For the distinguishing characters, see the discussions under those species.

It is a graceful tree of easy culture in a frost-free climate, forming a fairly straight trunk and a round crown of attractive, dark green foliage. Brenan and Greenway record that it produces a useful timber and that the leaves are browsed by stock.

13. *A. lophantha* (Willd.) Benth. in Hook. Lond. Journ. Bot. 3: 86 (1844); Fl. Austral. 2: 421 (1864).

Type: It is not known if a specimen is preserved on which Ventenat, Jard. Cels. t. 20, based his description and figure; if not, the latter will suffice as the type.

*Acacia lophantha* Willd. Sp. Pl. 4: 1070 (1806); DC., Prodr. 2: 457 (1825).

*Mimosa distachya* Vent. Jard. Cels. t. 20 (1800 or 1801), non Cav. Ic. 3: 48, t. 295 (1794 or 1795).

Type: As above.

*Albizia distachya* (Vent.) MacBride in Contrib. Gray Herb. n.s. 59: 3 (1919); Salter in Adamson and Salter, Fl. Cape Penins. 452 (1950).

*Tree* 4–7 m tall; branchlets usually velvety pubescent. *Leaves* 20–25 cm long and 11–18 cm broad; petiole 3–7 cm long; petiole and rachis pubescent; pinnae 7–12 pairs; leaflets 20–35 pairs, linear oblong, 7.5–11 mm long and 2–2.5 mm broad, sparingly pubescent to glabrous, oblique at the base, apex obtuse to rounded, mucronulate; midrib nearer to upper margin. *Inflorescence* spicate, 4–8 cm long, axillary, 1–3 per axil; peduncle 0.8–1.5 cm long, fulvo-tomentose. *Flowers* creamy to yellowish; pedicels 1–2.5 mm long. *Calyx* campanulate, 2–2.5 mm long, 5-toothed, pubescent. *Corolla* 5.5–6.5 mm long, 5-lobed, appressed pubescent; tube subcampanulate, 4–5 mm long; lobes ovate, cucullate, 1.5 mm long. *Stamens* 1.3–1.5 cm long, united at the base for 1.5–2.5 mm. *Ovary* glabrous, 2.5 mm long, very shortly stipitate; style filiform, exceeding the stamens by 6–7 mm. *Pod* several seeded, linear to linear-oblong, 6–11 cm long and 1.4–1.6 cm broad, flat, semi-woody, light to dark brown; margin slightly thickened, straight or nearly so; position of seeds clearly evident as raised bumps on the valve; seeds, when mature, loose and rattling in the pod.

Native of the south-western coastal region of Western Australia and naturalised in South Africa, especially along the coast from Humansdorp to the Peninsula.

NATAL.—South Coast, Wood 10588 (NH).

CAPE PROVINCE.—Humansdorp: Rogers 3021; Fourcade 3934 (BOL). Knysna: District Forest Officer in PRE 8707. Riversdale: Corente River Farm, Muir in Hb. Galpin 5092. Caledon: Kogel Bay, Parker 4206 (BOL). Cape Peninsula: Simons-town, Watt and Brandwijk 1682; Rondebosch, Gerstner 6135; Edinburg Estate, Salter 7356 (BOL).

It is not known when this species was introduced into South Africa. The earliest herbarium specimen seen is from the Riversdale District, dated December, 1908, when it was already recorded as "common on river banks". Collectors describe it as almost a ruderal weed, being common and gregarious along river banks, forest margins and in wooded ravines.

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## Studies of Wood-Rotting Fungi:

### 1. Cultural Characteristics of some Common Species.

By

G. C. A. van der Westhuizen.

It is often essential to identify the organisms causing decay to timber. Since a sporophore is seldom present, diagnostic features other than those important ones usually provided by the sporophore must be sought. It has long been known that wood-rotting fungi grow readily on artificial media, but only comparatively recently have cultural characters been used as in aid in the identification of non-fruiting mycelium. A difficulty peculiar to the identification of these fungi in culture is that the morphological characters shown are applicable directly to the species only and cannot be used in the identification of other species in the same genus.

Among the first workers in this field were Long and Harsch (12) and Fritz (11), who established criteria for distinguishing wood-rotting fungi in pure culture. This work was followed by studies of fungi causing decay of a specific host, or the species of a single genus in artificial culture. Bavendamm (1) and Davidson, Campbell and Blaisdell (9) showed that the behaviour of decay fungi on media containing gallic acid and tannic acid is a valuable aid in the identification of the fungus. But the different workers followed different methods so that it was still difficult or impossible to identify a fungus from culture unless many different methods were followed. Recently, Nobles (16) made an exhaustive study of the various methods and incorporated many of these into a standard procedure. This procedure has been followed, with some modification, by da Costa, Matters and Tamblyn (8). The macroscopic features of the colony are described in terms defined by Long and Harsch (12). Colours are recorded according to Ridgway's Colour Standards or the Munsell Book of Colour. The behaviour of the fungus on 0.5 per cent gallic acid and tannic acid in malt agar, and the growth rate and appearance on 1.5 per cent malt agar are noted. These features, as well as the nature of the host plant, the presence of fructifications and the microscopic characters, are expressed by a system of numerals termed the key pattern. Each digit refers to a specific character. Digits are arranged in eleven columns in ascending numerical order. For workers to whom Nobles' (16) paper is not readily available, the list indicating the meaning of each digit is appended below.

In the present paper, the cultural characters of a number of fungi are described. Some of them have been described before by other workers, but are included here to emphasize the similarities or differences between specimens from South Africa and elsewhere. Others are South African species and their cultural characteristics are described here for the first time.

#### METHODS AND MATERIALS.

The methods followed were those described by Nobles (16) and da Costa *et al.* (8) but with small modifications. The fungi were grown on 1.5 per cent Difco malt extract agar in three inch Petri dishes, each plate containing 30 ml. of medium. Inocula were cut out with a sterile cork borer of 10 mm diameter from the youngest part of an

actively growing colony and placed mycelium downwards near one side of the plate. Six plates of each fungus were incubated at 26° C., one plate being removed and placed in diffuse daylight at room temperature at weekly intervals. All cultures were examined at weekly intervals for changes of colour and other characteristics. All colours are described according to Ridgway's terminology (19).

The oxidase tests were carried out on media containing 1·5 per cent Difco malt extract agar and 0·5 per cent gallic acid and tannic acid, respectively, as described by Davidson, Campbell and Blaisdell (9). Incubation was at 26° C. for seven days or fourteen days for the slower growing species.

LIST INDICATING THE MEANING ATTACHED TO EACH DIGIT AS USED IN THE KEY PATTERN.

[NOBLES; (16) p. 291.]

*First column:* Host.

1. Occuring on broad-leaved trees.
2. Occuring on coniferous trees.

*Second column:* Colour of mycelial mat.

1. Mat remaining white, pale yellow or pale pink for six weeks.
2. Mat yellow or brown, at least when mature.

*Third column:* Reaction on media containing gallic acid and tannic acid.

1. Diffusion zone present.
2. Diffusion zone lacking.

*Fourth column:* Septation of hyphae.

1. Clamp connections present on all parts of mat but may be lacking on fibre hyphae.
2. Simple septa on all hyphae.
3. Hyphae of advancing zone with simple septa, those of older part of mat with clamp connections.
4. Multiple clamp connections present, at least in the advancing zone.

*Fifth column:* Special structures.

0. Contorted incrustated hyphae.
1. Cystidia or gloeocystidia.
2. Setae or setal hyphae.
3. Bulbils.
4. Rigid hyphae with right-angled branches.
5. Cuticular cells, forming a pseudo-paranchymatous layer.
6. Hyphae with numerous interlocking projections.
7. Swellings on hyphae.
8. Lactiferous cells.
9. No special structures.

*Sixth column:* Chlamydospores.

1. Chlamydospores present.
2. Chlamydospores absent.



## KEY TO THE FUNGI DESCRIBED IN THIS PAPER.

Host.	Mat Colour.	Oxidase.	Septation.	Special Structures.	Chlamydospores.	Conidia.	Oidia.	Growth Rate.	Fruiting.	Reverse.	
1	1	1	1	1	2	2	2	1	1	2	S. purpureum.
1	1	1	1	1	2	2	2	1	1	3	S. purpureum.
1	1	1	1	9	1	2	2	1	1	3	T. cingulata.
1	1	1	1	9	1	2	2	1	2	3	T. cingulata.
1	1	1	1	9	1	2	2	2	1	2	P. hirsutus.
1	1	1	1	9	1	2	2	2	1	2	S. commune.
1	1	1	1	9	1	2	2	2	1	3	S. commune.
1	1	1	1	9	1	2	2	2	2	2	S. commune.
1	1	1	1	9	1	2	2	2	2	3	S. commune.
1	1	1	1	9	2	2	1	2	2	3	L. palisoti.
1	1	1	1	9	2	2	2	1	1	3	P. hirsutus.
1	1	1	1	9	2	2	2	1	2	3	P. hirsutus.
1	1	1	4	9	2	2	2	1	2	2	S. hirsutum.
1	1	1	4	9	2	2	2	1	2	3	S. hirsutum.
1	1	2	1	9	1	2	2	2	1	2	S. commune.
1	1	2	1	9	1	2	2	2	1	3	S. commune.
1	1	2	1	9	1	2	2	2	2	2	S. commune.
1	1	2	1	9	1	2	2	2	2	3	S. commune.
1	1	2	1	9	2	2	2	1	1	2	P. vaillantii.
1	1	2	1	9	2	2	2	1	2	2	P. vaillantii.
1	1	2	1	9	2	2	2	2	1	2	P. vaillantii.
1	1	2	1	9	2	2	2	2	2	2	P. vaillantii.
1	1	2	4	9	2	2	2	1	2	2	C. arida.
1	2	1	1	0	2	2	2	1	1	3	T. proteus.
1	2	1	1	0	2	2	2	1	2	3	T. proteus.
1	2	1	1	6	2	2	2	1	1	3	P. arcularius.
1	2	1	1	6	2	2	2	1	2	3	P. arcularius.
1	2	1	1	7	2	2	2	1	2	3	A. rude.
1	2	1	1	9	1	2	2	1	1	2	P. sanguineus.
1	2	1	1	9	1	2	2	1	1	3	P. sanguineus.
1	2	1	1	9	1	2	2	1	2	1	L. sajor-caju.
1	2	1	1	9	1	2	2	1	2	2	P. sanguineus.
1	2	1	1	9	1	2	2	1	2	3	P. sanguineus.
1	2	1	1	9	2	2	2	2	2	2	G. colossus.
2	1	1	1	9	1	2	2	1	1	3	P. hirsutus.
2	1	1	1	9	1	2	2	1	2	3	P. hirsutus.
2	1	1	1	9	2	2	2	1	1	3	L. palisoti.
2	1	1	1	9	2	2	2	1	2	3	P. hirsutus.
2	1	1	1	9	2	2	2	1	2	3	P. hirsutus.
2	1	1	4	9	2	2	2	1	2	2	S. hirsutum.
2	1	1	4	9	2	2	2	1	2	3	S. hirsutum.
2	1	1	4	9	2	2	2	2	2	2	S. sanguinolentum.
2	1	2	4	9	2	2	2	1	2	2	C. arida.
2	2	1	1	9	1	2	2	1	1	2	P. sanguineus.
2	2	1	1	9	1	2	2	1	1	3	P. sanguineus.
2	2	1	1	9	1	2	2	1	2	2	P. sanguineus.
2	2	1	1	9	1	2	2	1	2	3	P. sanguineus.
2	2	1	1	9	1	2	2	1	2	3	P. sanguineus.
2	2	2	1	9	2	2	2	2	2	2	G. colossus.

*Seventh column:* Conidia.

1. Conidia present.
2. Conidia absent.

*Eighth column:* Oidia.

1. Oidia present.
2. Oidia absent.

*Ninth column:* Rate of Growth.

1. Rapid growth, plates covered in one to two weeks.
2. Moderately rapid, plates covered in three to four weeks.
3. Slow, plates covered in five to six weeks.
4. Very slow, plates not covered in six weeks.

*Tenth column:* Fruiting.

1. Fruiting before the end of six weeks.
2. No fruiting.

*Eleventh column:* Effect on Agar.

1. Reverse brown, at least in part, before the end of six weeks.
2. Reverse unchanged, or not darker than honey yellow in six weeks.
3. Reverse bleached, at least in part, before the end of six weeks.

1. *Amauroderma rude* (Berk.) G. H. Gunn. (Pl. 1; Fig. 1, Pl. 4, Fig. 1.)

Key pattern: 1 2 1 1 7 2 2 2 1 2 3.

*Growth characters:* Growth is rapid, the colony reaching a radius of 40 mm in seven days and covering the plate in two weeks. The advancing zone is even, transparent, appressed for about 0.5 mm, then slightly raised. The mat is at first white, cottony, but after two weeks, thin strands of mycelium appear and the mycelium darkens to "pale brownish drab" in some places. The colour darkens gradually as the mat becomes more felty or sub-felty in places and dark "hairs" start growing out onto the side of the dish. After six weeks, the mat is mostly "buffy brown" and sub-felty to crustose in places with patches of "avellaneous", "olive brown", "wood brown" and "natal brown". The mat is tough but separates readily from the agar and a faint, fragrant odour is given off. Reverse, bleached to "ochraceous buff" but later mottled with lines of "buckthorn brown" and "warm blackish brown" in the agar.

On gallic and tannic acid media there is good growth, the colonies reaching diameters up to 45 mm with strong diffusion zones up to 50 mm diameter after seven days.

*Hyphal characters.*

*Advancing zone.*—Hyphae hyaline, thin-walled, branched, septate with simple clamps of the "eyelet" type, 3–6  $\mu$  wide.

*Aerial mycelium.*—(a) Hyphae as in the advancing zone. (b) Fibre hyphae numerous, hyaline, without lumen and walls thick and refractive, 2–3  $\mu$  wide. (c) Hyphae with thick, refractive walls and narrow lumina which widen towards the tip and with deeply staining contents, 4–6  $\mu$  wide. (d) Wide hyphae, 4–6  $\mu$  wide, with slightly thickened, hyaline walls, clamp connections at the septa and wide lumina with deeply staining contents, with narrow thick-walled fibre hyphae, 2–3  $\mu$ , branching from them. (e) Narrow fibre-like hyphae, 2–3  $\mu$ , with thickened walls, at first hyaline, later brown, with inflated terminal or intercalary parts up to 20  $\mu$  wide, forming a tough, crustose skin on the mat.

*Submerged mycelium*.—Hyphae as in the advancing zone.

*A. rude* is very common in wattle plantations in South Africa and has been reported as the cause of decay of stumps and roots of *Acacia mollissima*. It has also been found on unspecified dead wood (10). With its unique key pattern and combination of readily recognizable microscopic features, the identification of this fungus from culture should be relatively easy.

## 2. *Coniophora arida* (Fries) Karst. (Pl. 1, Fig. 2; Pl. 4, Fig. 2.).

Key pattern: (1, 2) 1 2 4 9 2 2 2 1 1 2.

*Growth characters*.—Growth is fast, the colony reaching a radius of 38 mm after seven days and covering the plate in two weeks. The advancing zone is bayed and hyphae are raised right to the limit of growth. The mycelium is at first raised, silky, but becomes appressed after two weeks and thin rhizomorphs begin to appear and radiate from the inoculum over the surface of the agar. After 3–4 weeks the surface appears uneven or lacunose with hyphae thin and silky and the agar surface almost liquified. No further changes take place. The colour of the mat is at first hyaline, later turning pale greyish. The mat remains soft and adherent to the agar which is slightly bleached or remains unchanged. A faint odour is emitted.

On gallic and tannic acid media, no diffusion zones are found, while the colony reaches diameters of 60 mm on the former and 15 mm on the latter medium after seven days incubation.

*Hyphal characters*.

*Advancing zone*.—Hyphae smooth, branching, nodose-septate with multiple clamps arranged in a whorl, often with a whorl of branches from the clamps. Hyphae are usually 3–6  $\mu$  wide.

*Aerial mycelium*.—(a) Hyphae as in advancing zone, 2.5–10  $\mu$ . (b) Hyphae with simple clamps, 3–6  $\mu$ . (c) Wide hyphae with simple septa are present together with the ordinary hyphae in the rhizomorphs on the surface.

*Submerged hyphae*.—(a) Hyphae as in the advancing zone. (b) Knobbly, tortuous, branching hyphae with simple septa 2–6  $\mu$  wide.

Comparison with Nobles' key shows that *C. puteana*, to which *C. arida* is closely related, has an identical key pattern. There is indeed a very close resemblance between the cultures of these two species and only a few small characters separate them. In *C. arida* cultures, the advancing zone is bayed and the mat remains uncoloured while the mat of *C. puteana* may be coloured and the margin even. These differences are, however, so small as to suggest that the two fungi are probably different forms of the same species.

*C. arida* has been found to cause a brown rot of coniferous trees but also occurs saprophytically on deciduous trees such as *Acacia mollissima*.

## 3. *Ganoderma colossum* (Fr.) Bres. (Pl. 1, Fig. 3; Pl. 4, Fig. 3.).

Key pattern: (1, 2) 2 2 1 9 2 2 2 2 2 2.

*Growth Characters*.—Growth is moderately fast, the colony reaching a radius of 65 mm after 14 days. The advancing zone is even, slightly raised and is preceded by a zone of turbid agar about 8 mm wide. At first, the mat is silky but after two weeks, patches or tufts of cottony mycelium start to form on the sides of the dish. These

later become compacted into woolly or felty pads up to 5 mm wide around the edge of the mat. The young mat is white and remains so for longer than six weeks, but the dense mycelium on the sides of the dish turns to "cream color" or "buff yellow" after three to four weeks and darkens to "antimony yellow" and "cinnamon buff". The mat remains soft and adherent to the agar, while the reverse remains unchanged.

On gallic and tannic acid media there is good growth, the colonies reaching diameters of about 35 mm after seven days but no diffusion zones are formed. On tannic acid medium, a clear zone is formed slightly larger in diameter than the colony.

#### *Hyphal characters.*

*Advancing zone.*—Hyphae thin-walled, branched, nodose-septate with simple clamps of the "eyelet" type, often with branches arising opposite clamps, 3–6  $\mu$  wide.

*Aerial mycelium.*—(a) Hyphae as in the advancing zone. (b) Thin-walled hyphae without clamps and few simple septa, 1.5–2  $\mu$  wide. (c) Hyphae as in advancing zone but with walls light brown. (d) Hyphae with deeply staining contents and simple septa, irregularly widened and distended, 5–8  $\mu$  diameter.

*Submerged mycelium.*—(a) Hyphae as in the advancing zone. (b) Much branched hyphae with simple septa.

*G. colossus* has been isolated from *Pinus hondurensis* and *Callitris robusta* in Natal on which it causes an extensive collar rot. It also attacks eucalypts (14).

There are no marked morphological features by which *G. colossus* can be identified in culture. The restricted host range, the absence of a diffusion zone on the oxidase media together with the colour of the mycelial mat, which so closely resembles the colour of the large fructifications, and the microscopic appearance of the hyphae, should allow the easy identification of a culture of this fungus.

#### 4. *Lentinus sajor-caju* Fr. (Pl. 1, Fig. 4; Pl. 4, Fig. 4).

Key pattern: 1 2 1 1 9 1 2 2 1 2 1.

*Growth characters.*—Growth is rapid, the colony reaching a radius of 55 mm in seven days and the plate being covered in ten days. The advancing zone is even to slightly bayed, appressed, silky for 2–3 mm behind the tips and then raised. The mat is at first cottony to woolly, turning felty to sub-felty with nodulose or granular bands over the surface. As the culture ages, some areas become sub-felty to crustose. At first, the mat is white, but, after three weeks, patches of "light quaker drab" appear, but some darken to "quaker drab" or "mouse grey" so that the culture assumes a grey, marbled appearance. The agar is bleached but then darkens to "warm buff" with dark brown wavy lines giving a mottled appearance.

After two weeks growth, the edge of the mat turns upward and inward and small hyaline papillae appear, growing out from the mat and appressing their ends against the glass side of the dish. A sweet, fragrant odour is emitted by the fungus.

On gallic and tannic acid media, there are strong diffusion zones of 25–40 mm on the two media respectively, after seven days, while the colonies reach diameters of 15 mm and 35 mm.

#### *Hyphal characters.*

*Advancing zone.*—Hyphae thin-walled, branching, nodose-septate with simple clamps of "eyelet" type, 3–5  $\mu$  wide.



*Aerial mycelium*.—(a) Hyphae as in advancing zone. (b) Fibre hyphae numerous, thick-walled, branched or unbranched,  $1.5\text{--}2.5\ \mu$ . (c) Chlamydospores hyaline, elliptical, oval or short, cylindrical with rounded ends,  $6\text{--}8 \times 9\text{--}12\ \mu$ . (d) Hyphae with thin walls and bladderlike swellings and projections which later turn brown to form a crustose layer.

*Submerged mycelium*.—Hyphae as in the advancing zone but with occasional chlamydospores.

The most striking feature of this culture is the appearance of the papillae which seem to push the edge of the colony away from the sides of the Petri dish. This feature, together with the strong fragrant odour given off by the mycelium and the unique key pattern, should establish the identity of the culture with certainty.

*L. sajor-caju* causes a white rot of felled deciduous trees.

5. *Lenzites palisoti* Fr. (Pl. 1, Fig. 5; Pl. 4, Fig. 5.).

Key pattern: (1, 2) 1 1 1 9 2 2 1 2 2 3.

*Growth characters*.—Growth is moderately fast, the plate being covered in three weeks. The advancing zone is even, thin and closely appressed to the medium. The mat is at first thin, with a chamois texture and later slightly farinaceous with numerous tiny, clear droplets of liquid on it. Later it thickens, becoming compacted felty and slightly furrowed in the thicker parts. Thin, tough, smooth pads may develop over the surface. After six weeks the entire colony is farinaceous. The mat remains white throughout or a "cream color" on some of the thickened pads. The agar is bleached and the reverse is yellowish.

The mat is tough, adherent to the agar and emits a strong, sweetly fragrant, slightly musty odour.

On the oxidase test media, there are strong diffusion zones with growth up to 32 mm diameter on gallic acid and 10 mm diameter on tannic acid in seven days.

*Hyphal characters*.

*Advancing zone*.—Hyphae thin-walled, simple or branched nodose-septate with simple clamps often branching from the clamps,  $1.5\text{--}4\ \mu$  diameter.

*Aerial mycelium*.—(a) Hyphae as in advancing zone. (b) Fibre hyphae numerous, thick-walled, with narrow lumina which widen characteristically at the tips,  $3\text{--}4\ \mu$  diameter. Walls sometimes dilated into a vesicle as well. (c) Oidia elongate, cylindrical, with rounded ends or barrel-shaped to nearly globose,  $4\text{--}9 \times 2\text{--}4\ \mu$ .

*Submerged mycelium*.—Hyphae as in advancing zone but more tortuous and with more clamps,  $2\text{--}4\ \mu$  diameter.

The strong, fragrant odour emitted by this fungus and the pure white mat with its dewy appearance, should give an indication of its identity which may be confirmed by the presence of the characteristic fibre hyphae and the unique key pattern. The digit denoting swellings on hyphae is not included in the key pattern because these swellings are only seen very occasionally.

The key pattern denotes the presence of clamps on the hyphae but this fungus has a tendency to revert to the haploid condition after repeated subculture. This is accompanied by loss of vigour as demonstrated by a retardation in the growth rate, an increased production of oidia and growth with a very strongly indented margin. As the characters otherwise remain unchanged and new isolates are invariably diploid, the key pattern is presented as applicable to new isolates.

*L. palisoti* is a very common cause of white rot on timber in use but occurs on a number of living trees as well (10).

6. *Polyporus arcularius* Batsch ex Fries (Pl. 1, Fig. 6; Pl. 4.).

Key pattern: 1 2 1 1 6 2 2 2 (1, 2) 3.

*Growth characters*.—Growth is rapid, the colony reaching a radius of 43 mm in seven days and covering the plate after 14 days. The advancing zone is even, thin, appressed for 2–3 mm, then raised. The aerial mycelium is at first white, cottony to woolly, soon becoming more compact and granulose to lacunose felty, with crustose or skinlike and brittle areas. The white mat soon shows irregular patches of “russet” to “cinnamon brown” with a thin brown zone line appearing where the mat meets the agar at the sides of the dish. With progressing age, the culture assumes a mottled appearance with white areas mingled with “russet”, “mars brown”, “Prouts brown” and “mummy brown” patches and lines. The crustose, dark-coloured patches often have raised edges where they meet the white areas. The mat is tough after six weeks and a faint, yeasty odour is noticeable. Stalks of pilei appear after 2–3 weeks on some cultures and elongate into numerous contortions but bear normal pilei at their ends. The reverse of the colony may be bleached or turn “honey yellow”. Lines of “antique brown” to “Prout’s brown” appear in most cultures in the bleached agar.

On gallic and tannic acid media, strong diffusion zones of 55 mm diameter appear under colonies which reach diameters of 30 mm and 50 mm on the two media, respectively.

*Hyphal characters*.

*Advancing zone*.—Hyphae thin, branching, nodose-septate with simple clamps, 2–4  $\mu$  wide.

*Aerial mycelium*.—(a) Hyphae as in the advancing zone. (b) Fibre hyphae numerous, walls thick, refractive, branched, 1.5–2.5  $\mu$ . (c) Hyphae from dark skin-like areas, nodose-septate, thick-walled, often without lumina, buffy brown in KOH with numerous short side branches or knoblike projections, interlocked to form a tough, coherent mat which defies separation into single elements. Fruit body: Basidia hyaline, 14–16  $\times$  4–5  $\mu$  with four sterigmata. Basidiospores: smooth, oblong-elliptical, hyaline, 6  $\times$  2.5  $\mu$ .

*Submerged mycelium*.—Hyphae as in the advancing zone.

The above description corresponds closely with Nobles’ description (16) except for colour, which in my cultures was always browner. No chlamydospores were observed in these cultures. The formation of normal fructifications with their characteristic large pores took place very readily on some of the cultures.

*P. arcularius* is found fairly frequently on decayed wood of broad-leaved trees in contact with the soil but does not seem to be important as a wood destroyer in South Africa.

7. *Polyporus sanguineus* Linn. ex Fries (Pl. 2, Fig. 1; Pl. 4, Fig. 7.).

Key pattern: (1, 2) 2 1 1 9 1 2 2 1 (1, 2) (2, 3).

*Growth characters*.—Growth is fast, the colony reaching a radius of 50 mm in seven days and covering the plate in twelve days. The advancing zone is even, appressed for 1–2 mm then raised, hyaline. The texture is at first cottony to woolly, lacunose in the denser parts and later granular, turning to velvety or chamois near the inoculum. From the inoculum, broad, shallow furrows radiate out to some distance behind the advancing edge. At about four weeks incubation, the dense parts of the colony become compacted into tough, felty to velvety pads, often raised above the level of the surrounding mat. On some of these, pores are developed which shed white spore deposits if the plate is inverted.

The mat is at first white but after one to three weeks, tinges of "pale salmon color" appear which later deepen to "salmon color", "apricot orange", "carnelian red" or "flame scarlet" in the older parts with occasional "cinnamon rufous" near the edge of the newest growth. The reverse is unchanged in some cultures and bleached in others. A faint, pleasant odour is present.

On gallic and tannic acid media, there are strong diffusion zones of up to 65 mm diameter, while colony diameters vary from 35–55 mm on gallic acid and 0–55 mm on tannic acid media.

#### *Hyphal characters.*

*Advancing zone.*—Hyphae thin-walled, smooth, branched, nodose-septate with simple clamps of the "eyelet" type, 2–5  $\mu$  wide.

*Aerial mycelium.*—(a) Hyphae as in the advancing zone. (b) Fibre hyphae with thick, refractive walls and no lumina, branching, very numerous, 2–4  $\mu$  wide. (c) Chlamydospores smooth, hyaline, terminal or intercalary, rare in some cultures, more numerous in others, with walls slightly thickened, 4–9  $\times$  6–14  $\mu$ .

*Fruit body.*—(a) Basidia clavate, 4·5–6  $\mu$  wide with four spores. (b) Basidiospores hyaline, short, cylindrical, 4·5–6  $\times$  2·5–3  $\mu$ .

*Submerged mycelium.*—(a) Nodose-septate hyphae, (b) fibre hyphae and (c) chlamydospores as above.

The cultures described here are very similar to those described by Nobles (16) and Matters *et al.* (15). Like those described by the latter authors, the South African fungi tend to bleach the medium but differ from them by having higher growth rates.

Bose (2) noticed that cultures of *P. cinnabarinus* differed from those of *P. sanguineus*, two species considered to be identical by Wakefield (2) and Lloyd (13), in that the hyphae of the latter develop a pigment on their walls so that the whole mat looks orange, while the hyphae of the former remain white and the characteristic orange-red colours only appear when basidia initials are formed in the cultures. Colour is consequently confined to peroid areas of cultures of *P. cinnabarinus*. It has been noticed that amongst the cultures described here, there are some which tend to form colour at a later stage of development and in localized patches only. In the others, colour is formed at an early stage and is more or less of an even hue over the whole surface of the culture. The sporophores from which these cultures were made were, however, identified as those of *P. sanguineus*. This phenomenon is considered to be caused by differences between different strains of the same organism.

*P. sanguineus* can be readily recognized in culture by the bright orange-red colours formed, without recourse to microscopic examination.

This fungus is widely distributed throughout South Africa and has been found on living trees (Doidge 10) and on dead wood in which it causes a white rot.

#### 8. *Polystictus hirsutus* Wulf. ex Fries (Pl. 2, Fig. 2; Pl. 4, Fig. 8.).

Key pattern: (1, 2) 1 1 1 9 (1, 2) 2 2 1 (1, 2) 3.

*Growth characters.*—Growth is rapid, a radius of 55–60 mm being reached in one week, while the plates are covered in 9–10 days. The advancing zone is even, appressed or slightly raised. The mat is at first cottony but soon becomes woolly and compacted to felty or sub-felty in some places round the inoculum, but finally tough, dense, felty and slightly lacunose, with mounds of compact waxy mycelium over the surface.



Mycelium frequently grows out between the dish and cover to form poroid fructifications. The predominating colour is white but patches of "cream color" occur near the sides of the dish and on the poroid mounds. The reverse is rapidly bleached and cleared.

Growth on gallic acid medium does not occur or produces a mere trace of mycelium with a strong diffusion zone. On tannic acid, the colony may reach 40 mm diameter in seven days, while a strong diffusion zone, slightly wider, is formed. Odour is lacking or may be faint, sweetish.

*Hyphal characters.*

*Advancing zone.*—Hyphae hyaline, branched, nodose-septate with simple clamps, 3–5  $\mu$  wide.

*Aerial mycelium.*—(a) Hyphae as in the advancing zone. (b) Fibre hyphae very numerous, with walls thick and refractive, lumina narrow or lacking, aseptate, branched, 1.5–3  $\mu$ .

*Fructication.*—Basidia 4.5–6  $\mu$  diameter, having four spores. Basidiospores hyaline, even, cylindrical, 5–7  $\times$  2–5  $\mu$ .

*Submerged mycelium.*—(a) Hyphae as in advancing zone. (b) Chlamydospores observed in one isolate, terminal and intercalary, thin-walled, smooth, hyaline, 10–15  $\times$  4.5–7  $\mu$ .

The key pattern for *P. hirsutus* is identical with those of other fungi from which it can, however, be distinguished on the macroscopic appearance in culture. Nobles records, however, that the cultures of *Polyporus pubescens* and *P. zonatus* are closely similar to those of *P. hirsutus*. Although neither of these two species has been grown in culture by me yet, the former may not be a serious consideration in this respect as it is not at all common in this country. *P. zonatus* is more common and great care should be exercised in identification of cultures when there is the risk of confusing these two closely related species.

*P. hirsutus* causes a white rot of coniferous and hardwoods and has been reported on broad-leaved trees.

9. *Poria vaillantii* (D.C.) Fr. (Pl. 2, Fig. 3; Pl. 5, Fig. 1.).

Key pattern: 1 1 2 1 9 2 2 2 (1, 2) (1, 2) 2.

*Growth characters.*—Growth is moderately fast to fast, the plate being covered in twelve to twenty days. The advancing zone is even, appressed for 0.5 or 1 mm behind the extreme tips, then raised in a dense cottony or woolly mound but sinking again towards the inoculum. After three weeks, dense strands of hyphae form and radiate from the inoculum to the newer growth where their ends fan out into cottony plumes, which cling to the sides of the dish. With advancing age, the mycelium, clinging to the glass sides, is torn and becomes rather ragged through shrinkage of the agar. After two to four weeks, wide, shallow pores are formed on the dense mycelium of some cultures. Creamy spore deposits are formed if the plates are inverted.

The colour remains pure white throughout, except in the older parts of the fructification, which turn a pale cream colour. The aerial mycelium is easily stripped from a thin layer of mycelium which adheres to the agar. The reverse remains unchanged.

The fungus is negative for oxidase and no diffusion zones are formed. Growth on gallic acid may reach a diameter of 60 mm in one week, but no growth takes place on tannic acid.



*Hyphal characters.*

*Advancing zone.*—Hyphae thin-walled, branched, nodose-septate with simple clamps, often branching opposite a clamp,  $2.5\text{--}6\ \mu$  diameter.

*Aerial mycelium.*—(a) Hyphae as in the advancing zone. (b) Fibre hyphae without lumina, refractive, unbranched,  $2.5\text{--}3.5\ \mu$ . (c) Wide hyphae, irregularly swollen,  $6\text{--}10\ \mu$  in diameter.

*Fruit body.*—(a) Hyphae as above. (b) Basidia: clavate with four sterigmata  $6\text{--}8 \times 16\text{--}20\ \mu$ . (c) Basidiospores hyaline, oblong-ellipsoid, slightly flattened on one side,  $4.5\text{--}6 \times 3.5\ \mu$ .

*Submerged mycelium.*—(a) Hyphae as in the advancing zone. (b) Crystals numerous.

The cultures described here agree very closely with the descriptions of Nobles (16) and Matters *et al.* (15). No chlamydospores were seen, though they were noted by Cartwright and Findlay (3) but fibre hyphae were numerous in both the fructification and the hyphal strands. This fungus may readily be recognised by the thin mat around the inoculum with its radiating strands of mycelium, which spread out into fan-shaped areas near the younger parts of the colony. In test tubes, these fan-shaped structures form a plug of hyphae near the edge of the slope, while the hyphal strands lead up to it over a thin mycelial mat.

10. *Schizophyllum commune* Fries. (Pl. 2, Fig. 4; Pl. 5, Fig. 2.).

Key pattern: 1 1 (1, 2) 1 9 1 2 2 2 (1, 2) (2, 3).

*Growth characters.*—Growth is moderately fast, the colony reaching a radius of 22–48 mm in seven days, while the plate is overgrown after 3–4 weeks. The advancing zone is bayed or almost even, thin, appressed or raised. The mat is at first cottony but soon denser patches of felty mycelium are formed. As growth proceeds, more or less fan-shaped areas of dense, felty mycelium may develop with shallow furrows radiating from the inoculum. From these compact, felty patches of mycelium, the normal fructifications usually develop. At this stage, the mat is usually tough and free from the agar. The colour remains white throughout, but fructifications may be “pale buff”. There is a slight musty odour. The reverse remains unchanged or may bleach slowly.

On the oxidase reaction media, the colonies reach diameters of 35–65 mm on gallic acid and 35–50 mm on tannic acid, while a strong diffusion zone is produced on tannic acid medium only.

*Hyphal characters.*

*Advancing zone.*—Hyphae are thin branching, smooth, nodose-septate with simple clamps,  $2.5\text{--}5\ \mu$  wide.

*Aerial mycelium.*—(a) Hyphae as in the advancing zone but more frequently septate. (b) Fibre hyphae unbranched, with thick, refractive walls and narrow lumina,  $1.5\text{--}3\ \mu$ . (c) Thin-walled hyphae with short, narrow branches. (d) Chlamydospores: intercalary and terminal, hyaline, thick walled, sub-globose, oval or pyriform or elliptical, often divided by a single septum,  $4\text{--}20 \times 4\text{--}8\ \mu$ .

*Fruit body.*—Basidia: obovate or obclavate, often swollen at the top, with four sterigmata,  $15\text{--}20 \times 3\text{--}4\ \mu$ . Basidiospores: hyaline, cylindrical, rounded at the ends, obliquely apiculate,  $2\text{--}3 \times 5\text{--}7\ \mu$ .

*Submerged mycelium.*—(a) Hyphae as in the advancing zone. (b) Chlamydospores as above.

*Schizophyllum commune* is a very common saprophyte of timber (10) but has also been reported as a parasite of living trees (18). In culture, it is readily recognizable by the production of mature sporophores within a few weeks. Some cultures do not produce fructifications, but the presence of the thin-walled hyphae with the minute side branches, and the chlamydospores, which are usually present in large numbers, provide useful features for identification. The absence of a diffusion zone on gallic acid medium, in combination with these morphological characteristics, makes *S. commune* one of the easiest basidiomycetes to recognise in pure culture.

# 11. *Stereum hirsutum* (Willd.) Pers. (Pl. 2, Fig. 5; Pl. 5, Fig. 3.).

Key pattern: (1, 2) 1 1 4 9 2 2 2 1 2 (2, 3).

*Growth characters*.—Growth is rapid, the plate being covered in less than two weeks. The advancing zone is thin, even, appressed, but merges into the loose, cottony mycelium a few millimeters behind it. At two weeks, the culture has a thin, even cottony texture with little balls of dense compacted mycelium scattered through it. Gradually, the mycelium becomes denser and becomes compacted in some areas into smooth, felty or chamois areas.

The colour is at first hyaline, gradually turning creamy white to "cream color" with patches of "pinkish buff", "light buff" to "ochraceous tawny" on thickened parts at the rim of the dish. On some of the cultures are thickened pads exuding drops of dark amber liquid.

The reverse of the colony turns to "ochraceous buff" after the agar is bleached. The mycelial mat is at first soft, but later toughens somewhat in the felty areas. A musty odour is given off by the growing colony.

## *Hyphal characters*.

*Advancing zone*.—(a) Hyphae narrow, unbranched, with simple clamps over the septa, 1–2  $\mu$  wide. (b) Thin-walled hyphae 6–10  $\mu$  wide, with numerous, very conspicuous clamps arranged in whorls at the septa, branched, sometimes with branches from the clamps, often with narrow or wide side branches similarly nodose-septate or with simple septa or simple clamps at the septa.

*Aerial mycelium*.—(a) Hyphae as in the advancing zone but slightly wider, up to 12  $\mu$ . (b) Fibre hyphae with thick, refractive walls, sometimes faintly yellow, 1.5–3  $\mu$ . (c) Narrow, helicoid hyphae, thin-walled, 2–3  $\mu$  wide.

*Submerged mycelium*.—Hyphae as in the advancing zone but more narrow hyphae, 1–2  $\mu$  wide and much branched, are present.

*Stereum hirsutum* has been described in pure culture by Cartwright and Findlay (3), but these authors do not mention the coiled hyphae which occur quite frequently in cultures, whose features otherwise agree closely with their descriptions and which were made from sporophores of undoubted *S. hirsutum*. This common fungus is probably one of the easiest to recognise in culture as the scattered compact balls of mycelium and the coarse hyphae with whorled clamp connections are characteristic.

# 12. *Stereum purpureum* (Pers. ex Fr.) Fries (Pl. 2, Fig. 6; Pl. 5, Fig. 4.).

Key pattern: 1 1 1 1 1 2 2 2 1 1 (2, 3).

*Growth characters*.—Growth is rapid, the mat attaining 70 mm in seven days and the plate being covered in about ten days. The advancing zone is even or slightly bayed and appressed in a zone about 1 mm wide, but the hyphae are then raised. The

texture is coarse, silky at first, becoming plumose to farinaceous in patches. The mycelium finally turns felty with nodules of compact mycelium against the glass sides of the dish. The colour remains white but a "pale buff", thin rind of fructification may appear on the side of the dish. The reverse remains unchanged or may be slightly bleached before six weeks. The mat is at first soft and adherent but later becomes tougher. There is a slight, musty odour.

On gallic and tannic acid agar, there is good growth, the colony attaining 63 mm diameter on gallic acid and 42 mm on tannic acid. The diffusion zones are fairly strong but much smaller than the colony, being about 45 and 35 mm for the two media, respectively.

#### *Hyphal characters.*

*Advancing zone.*—Hyphae are smooth, thin-walled, simple or branching, nodose-septate with simple clamps, 4–6  $\mu$  wide.

*Aerial mycelium.*—(a) Hyphae as in the advancing zone but some are thinner, 2–6  $\mu$  wide. (b) Fibre hyphae narrow, thick-walled, sometimes branching. (c) Gloeocystidia vesicular, globose to almost pyriform, thin-walled, 8–12  $\mu$  diameter.

*Fructification.*—(a) Gloeocystidia as above. (b) Basidia clavate with four sterigmata, 3–5  $\times$  18–24  $\mu$ . (c) Spores elliptical to almost cylindrical, hyaline, smooth, obliquely apiculate, 3  $\times$  5  $\mu$ .

*Submerged mycelium.*—Hyphae as in the advancing zone, crystals octahedral or amorphous and numerous.

*S. purpureum* has been described in pure culture by Cartwright and Findlay (3) who noticed the swollen hyphae or vesicles which are characteristic of this fungus. Talbot (20) considers these structures to be gloeocystidia so that they are listed under the numeral for gloeocystidia in the key. *S. purpureum* has a key pattern unlike that of any other species so that it should be readily identifiable in this way. The rather conspicuous gloeocystidia are a valuable guide in this matter.

This fungus is best known in South Africa as a parasite of fruit trees where it causes a disease with readily recognizable symptoms. It has, however, been reported from *Populus* sp. and *Quercus* sp. (10), so that its inclusion here may aid its recognition on hosts other than fruit trees.

#### 13. *Stereum sanguinolentum* (Alb. and Schw. ex Fr.) Fr. (Pl. 3, Fig. 1; Pl. 5, Fig. 5.).

Key pattern: 2 1 1 4 9 2 2 2 2 2.

*Growth characters.*—Growth moderately rapid, the colony reaching a radius of 50 mm after fourteen days. The advancing zone is even, appressed, with sparse, thin, cottony mycelium extending to the limit of growth. The mat is at first white and downy and may remain so for some weeks, then turning "chamois" while it thickens to become cottony-floccose. At six weeks, the oldest parts are felty and coloured "light buff" to "capucine buff" or "yellow ochre". In some parts, especially near the edge, the mat is thin, skin-like and farinaceous or minutely granular. The mat remains soft and adherent to the agar and gives off a pleasant, sweet, mushroomy odour. The reverse remains unchanged or may turn "honey yellow".

On gallic and tannic acid media the diffusion zones are strong and about 30 mm in diameter, while the colonies grow to diameters of about 15 and 30 mm on gallic and tannic acid media, respectively.

*Hyphal characters.*

*Advancing zone.*—Hyphae hyaline, thin-walled, branched with simple septa and occasional large, simple clamps or paired clamps on the wider hyphae, 2–6  $\mu$ .

*Aerial mycelium.*—(a) Narrow hyphae with deeply staining contents and inconspicuous, simple septa or simple clamps, 1.5–5  $\mu$  wide. (b) Wide hyphae with granular contents, often with simple septa and multiple clamps present on the same hyphae, 3–6  $\mu$  wide. (c) Helicoid hyphae are fairly numerous, 2–3  $\mu$ .

*Submerged mycelium.*—(a) Hyphae as in the aerial mycelium. (b) Crystals large, octahedral.

This fungus causes collar and root rot of *Pinus taeda* in South Africa (14) but is also well known in North America as a cause of heart rot in coniferous trees. The South African strain fits the description by Nobles (16) very well, but the “conducting hyphae” with the swollen tips were not seen in culture, although they are present in the sporophores.

The most striking characteristics in culture are the presence of simple septa and multiple clamps in the same hyphae, the slow rate of growth and the thin mycelial mat. Its exclusive occurrence on coniferous trees, should aid in its identification from culture.

14. *Trametes cingulata* Berk. (Pl. 3, Fig. 2; Pl. 5, Fig. 6.).

Key pattern: 1 1 1 1 9 1 2 2 1 (1, 2) 3.

*Growth characters.*—Growth is moderately fast, the colony reaching a radius of 38 mm in seven days and covering the plate after two weeks. The advancing zone is even and appressed for 1 mm behind the extreme limit of growth, the hyphae then becoming raised. The mat is white and remains so. Texture is at first thin, downy or downy-cottony, becoming sub-felty or chamois near the inoculum. Later it becomes appressed, downy, cottony, with farinaceous areas near or round the inoculum. Fruiting areas first appear as white or “light buff” farinaceous or granular specks which soon turn dull pasty and grow together to form irregular masses which develop irregular pores near the inoculum or over the youngest growth. The mat becomes tough, remains free of the agar and does not emit any odour. The agar is quickly bleached to clear, transparent, milky white.

On gallic and tannic acid media, there is no growth but a strong diffusion zone about 50 mm diameter is found on gallic acid and a small, weak one on tannic acid.

*Hyphal characters.*

*Advancing zone.*—Hyphae narrow, branched, nodose-septate with simple clamps of “eyelet” type, often branching from the clamps, 2–4  $\mu$ .

*Aerial mycelium.*—(a) Hyphae as in the advancing zone. (b) Fibre hyphae with thick, refractive walls, unbranched and without lumina, numerous, 1.5–5  $\mu$ . (c) Chlamydospores ovate elliptical to sub-globose, thick-walled, terminal, 4–8  $\times$  6–12  $\mu$ .

*Fruit body.*—Basidia pyriform with four sterigmata. Basidiospores hyaline, globose, 3.7–4  $\mu$  in diameter.

*Submerged mycelium.*—Hyphae as in the advancing zone.

*Trametes cingulata* could possibly be confused in culture with *Polyporus zonatus* which has the same key pattern in some forms. It appears, however, from Nobles' description that *P. zonatus* has a thicker, denser mat than *T. cingulata* in cultures of six weeks old or less. *T. cingulata* is distinguished from other forms in nature by possessing a matt, black, upper surface to the sporophores. Cultures of this fungus were seen to develop this matt, black colour after 10–12 weeks in minute spots on the mycelium but visible only under 25  $\times$  magnification.



15. *Trametes meyenii* (Klotzsch) Lloyd. (Pl. 3, Fig. 3; Pl. 5, Fig. 7.).

Key pattern: 1 1 1 1 9 2 2 1 1 2 3.

*Growth characters.*—Growth is rapid, a radius of 65 mm being reached in seven days, while the plate is covered in ten days. The advancing zone is even, appressed for about 1 mm, then raised. The mat is at first cottony to woolly but soon becomes more dense and compact to felty, until at six weeks it is very tough, felty, slightly lacunose over parts of the surface and faintly striate with fine grains on some parts of the surface. By this time, it is leathery in appearance and consistency. At first, the mycelium is translucent white but turns pure white as the mat becomes denser. After 3–4 weeks, a “pale cream color” band, about 15 mm wide, appears over the surface about half-way across the Petri dish. The agar is rapidly bleached as growth proceeds, becoming colourless. The cream coloured reverse of the mat is visible through the agar after 4–5 weeks.

Good growth takes place on gallic and tannic acid, a diameter of 40 mm being reached on the former and 65 mm on the latter medium in seven days. Strong diffusion zones are present in both media.

*Hyphal characters.*

*Advancing zone.*—Hyphae thin-walled, simple or with short side branches or unbranched, often branching from clamps, nodose-septate, clamps simple, “eyelet” type, 2–5  $\mu$  wide.

*Aerial mycelium.*—(a) Hyphae as in advancing zone. (b) Fibre hyphae with thick, refractive walls, no lumina, branched, without clamps or septa, 2–5  $\mu$  wide, very numerous. (c) Oidia cylindrical with rounded ends, hyaline, 2–4  $\times$  3–6  $\mu$ .

*Submerged mycelium.*—Hyphae branching profusely, thin-walled, nodose-septate with simple clamps as in advancing zone, 2–5  $\mu$ .

The key pattern of this fungus is unique so that there should be no difficulty in the identification of an otherwise featureless culture. The rapidly growing aerial mycelium, which becomes compacted into the white, tough mat, should hint at its identity. Although characteristic features are lacking, there should be no difficulty in recognizing the fast-growing, tough mat of this fungus if it has been seen previously.

In old cultures in tubes, fructifications were seen when the mat was placed in a vertical position for 2–4 months but no fructifications formed in less than six weeks.

*T. meyenii* has been reported on broad leaved trees and is a common saprophyte on hardwoods (10).

16. *Trametes proteus* (Berk.) Fr. (Pl. 3, Fig. 4; Pl. 5, Fig. 8.).

Key pattern: 1 2 1 1 0 2 2 2 1 (1, 2) 3.

*Growth characters.*—Growth is rapid, the colony covering 55 mm in seven days and the entire plate in less than two weeks. The advancing zone is even, raised, white and the mycelium cottony. The mat is at first cottony but soon becomes appressed and sub-felty with irregular translucent places on the surface. The sub-felty areas later turn farinaceous. About half-way across the mat, a raised band of cottony mycelium may form which turns brownish after 3–4 weeks. On the sides of the dish and other places, fructifications form which start as areas of compacted, white mycelium, which later turn brown, and develop large, incomplete pores. Some areas may remain white or the entire culture may become overgrown with the cottony, brown hyphae. The agar is quickly bleached and the mat gives off a pleasant, fragrant, mushroomy odour.

On gallic and tannic acid media, there are strong diffusion zones after one week. No growth takes place on gallic acid in seven days. On tannic acid medium, the colony may reach a diameter of 35 mm in seven days, or no growth may occur.

*Hyphal characters.*

*Advancing zone.*—Hyphae simple or branched, hyaline, septate with simple clamp connections of the "eyelet" type occasionally branching from the clamps, 2–5  $\mu$  wide.

*Aerial mycelium.*—(a) Hyphae as in the advancing zone. (b) Fibre hyphae brown with thick walls and narrow lumina, aseptate, often branching but mostly simple, numerous, long, 2–5  $\mu$  wide. (c) Hyphae encrusted with crystals but not very numerous; 4–6  $\mu$ .

*Fruit body.*—(a) Basidia clavate to obpyriform with four sterigmata, 18–24  $\times$  6–10  $\mu$ . (b) Basidiospores hyaline, ovate to almost elliptical, obliquely apiculate, 3–4.5  $\times$  7.5–10  $\mu$ .

*Submerged mycelium.*—Hyphae as in the advancing zone but more richly clamped and branched, often with numerous, short, lateral branches.

The key pattern for *T. proteus* is unique so that cultures may be identified by direct consultation of the key. Indeed, the rapid growth of the felty mat, with its brown, tangled overgrowth of fibre hyphae that soon tend to form fructifications, are so characteristic, that cultures may be identified without recourse to microscopic examination, if this species has been seen in culture previously.

#### DISCUSSION.

It is evident that in identifying these fungi from culture, a very important consideration must always be their micromorphology. In the introduction to this paper, it was stated that identification from cultures must go directly to the species, because species in the same genus do not show common generic characters in culture. In the *Polyporaceae*, this is very noticeable if the fungi are named according to the traditional classification of Fries and others, based on external morphology. However, Cunningham (5), basing his work on the original observations of Corner (4), has recently proposed a classification of the polypores which groups the fungi according to the colour and morphology of the hyphae, and the type of basidium present. When Cunningham's system is applied, it is found that cultures of polypores do show certain microscopic features which characterise the genus. It was observed during the course of this work that the fungi described here as *Polyporus sanguineus*, *Polystictus hirsutus*, *Trametes cingulata* and *Trametes meyenii* all have hyaline, generative hyphae with clamps at the septa, hyaline, long, narrow, thick-walled fibre hyphae (or "skeletal" hyphae) and clavate basidia. These species are all grouped by Cunningham (6) under the genus *Coriolus*. On the other hand, *Trametes proteus* differs from these in possessing brown fibre hyphae. These brown hyphae distinguish the genus *Trametes* from *Coriolus* in Cunningham's classification.

Binding hyphae, which characterise those polypores with trimitic hyphal systems, were never seen in culture so that it is impossible to distinguish between dimitic and trimitic genera with hyaline hyphae. Nevertheless, Cunningham's system of classification does help to group cultures of polypores with common generic features and thus aids in the identification of an unknown polyporoid culture.

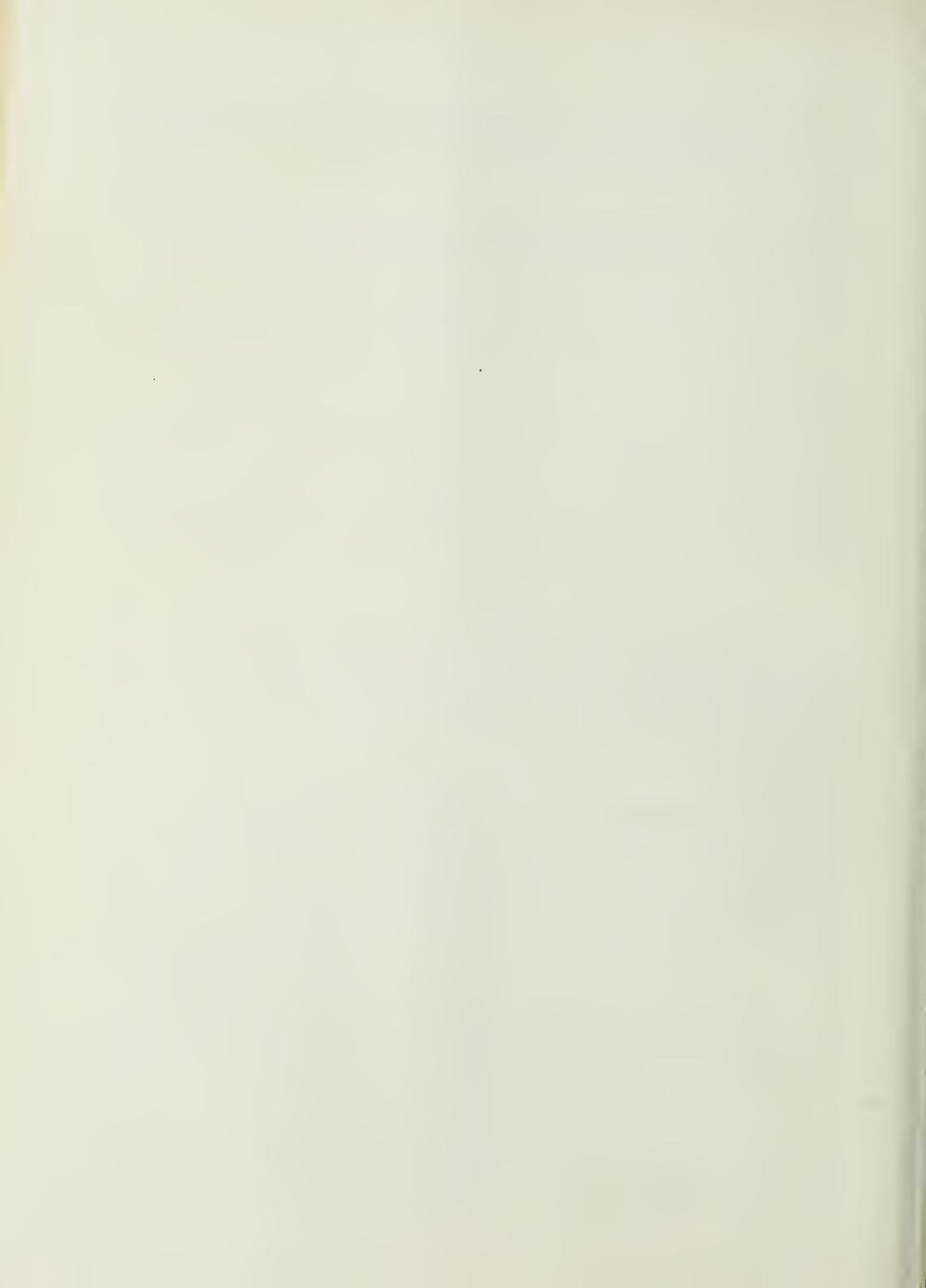
In the lower Hymenomycetes, a similar system of classification based largely on microscopic features, is being worked out, (Cunningham 7). As in the *Polyporaceae*, fungi grouped according to this system should show common generic features in culture. It appears, however, that many of the structures present in the fructifications of wood-rotting fungi, are not formed in the cultures. For this reason, the work of Cunningham is unfortunately of limited use in the identification of unknown cultures.

More recently, Pinto-Lopes (17) also proposed a classification of the *Polyporaceae*, based on their hyphal characteristics. He stated (p. 116), that the same types of hyphae are produced in culture as are present in the fructifications. His descriptions are, unfortunately, not sufficiently detailed for use in the identification of unknown polyporoid cultures.

In this paper, the traditional nomenclature for the *Polyporaceae* was adhered to for the sake of uniformity with earlier work and because the South African species have not yet been revised in the light of the new approach.

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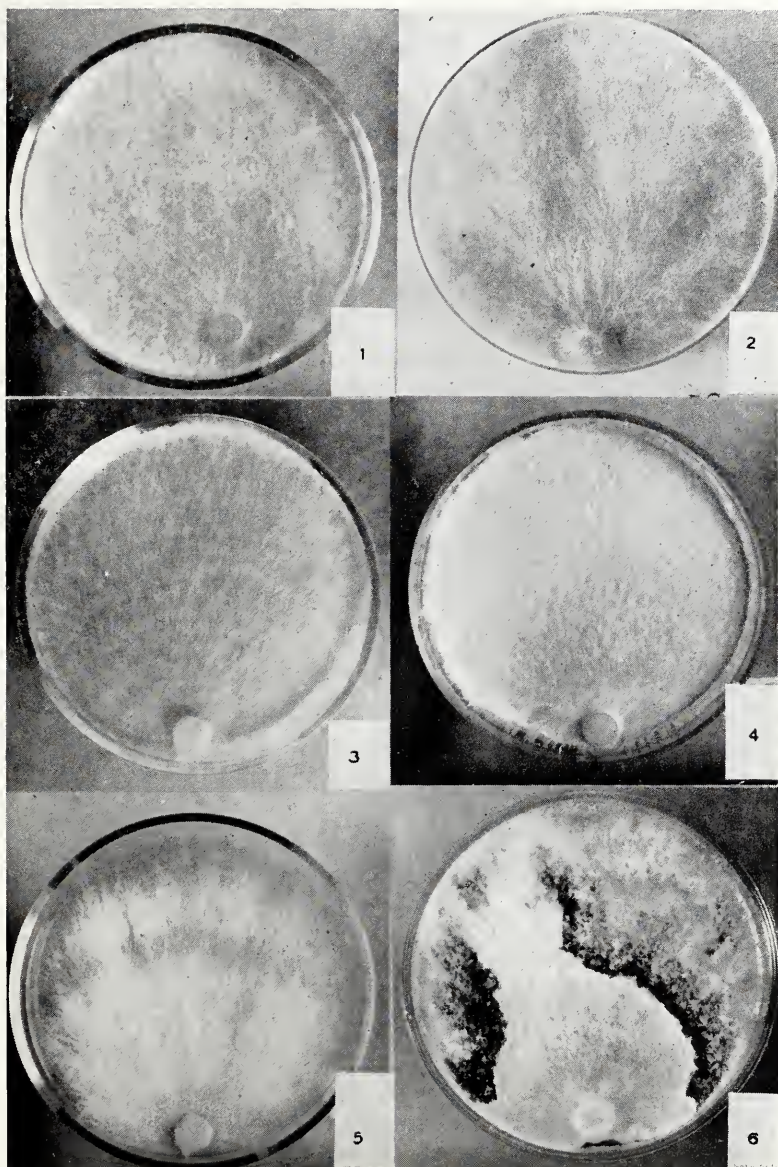


PLATE 1.—FIG. 1, *Amauroderma rude*, 2 weeks; FIG. 2, *Coniophora arida*, 3 weeks; FIG. 3, *Ganoderma colossum*, 3 weeks; FIG. 4, *Lentinus sajor-caju*, 2 weeks; FIG. 5, *Lenzites palisoti*, 2 weeks; FIG. 6, *Polyporus arcularius*, 3 weeks.

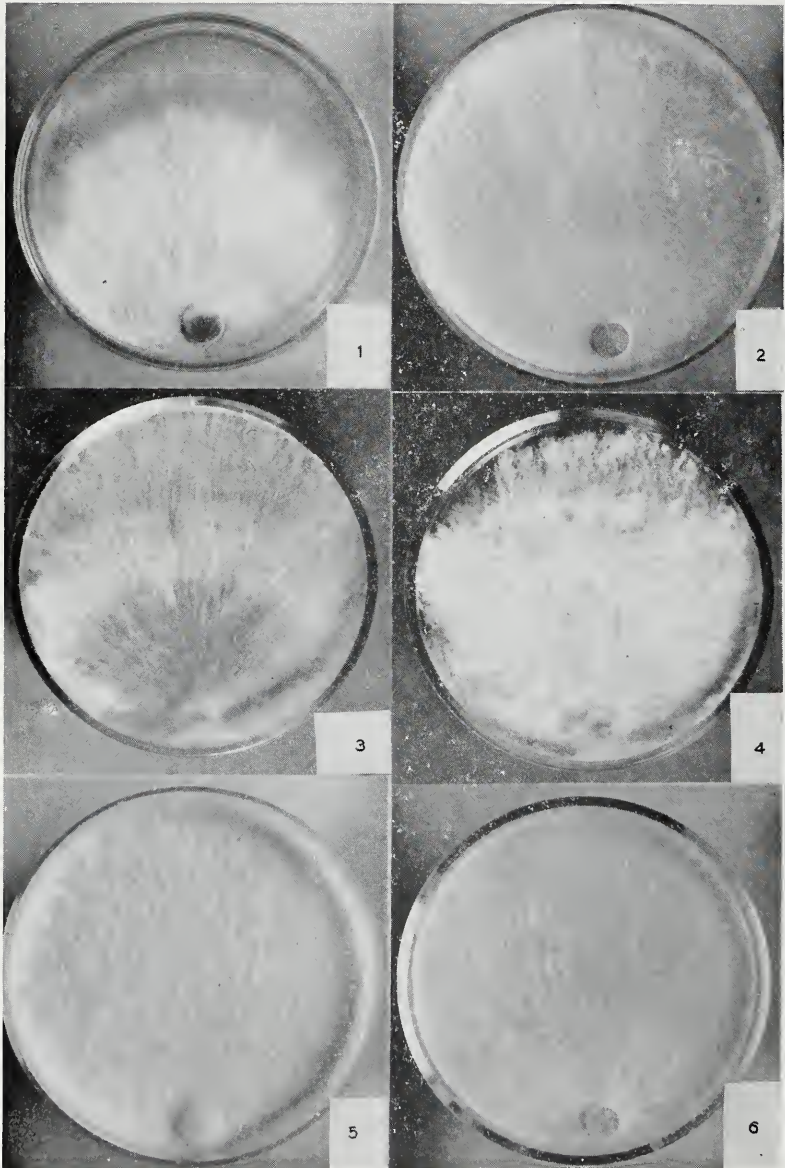


PLATE 2.—FIG. 1, *Polyporus sanguineus*, 2 weeks; FIG. 2, *Polystictus hirsutus*, 2 weeks; FIG. 3, *Poria vaillantii*, 3 weeks; FIG. 4, *Schizophyllum commune*, 3 weeks; FIG. 5, *Stereum hirsutum*, 2 weeks; FIG. 6, *Stereum purpureum*, 2 weeks.

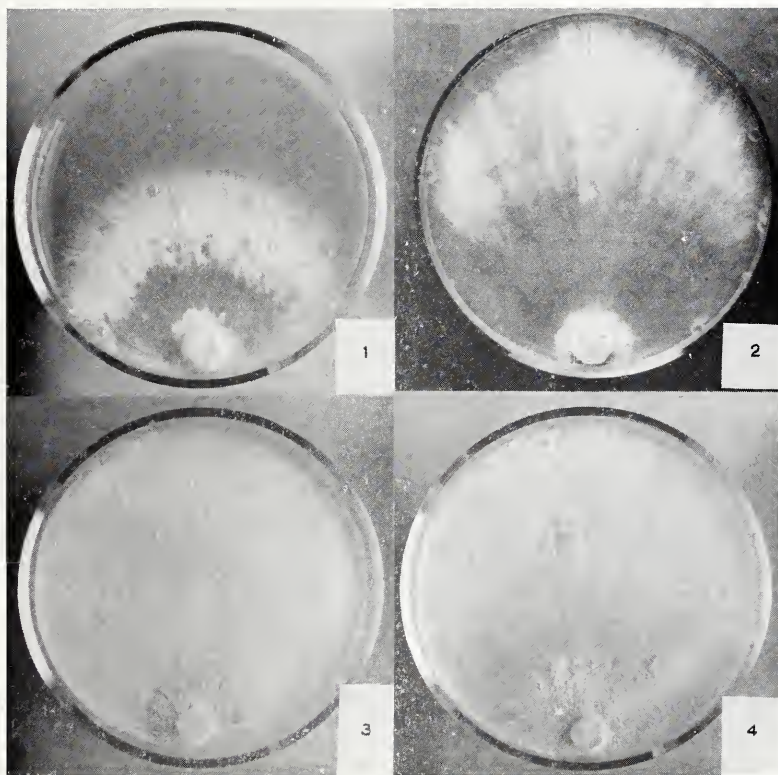


PLATE 3.—FIG. 1, *Stereum sanguinolentum*, 3 weeks; FIG. 2, *Trametes cingulata*, 3 weeks; FIG. 3, *Trametes meyenii*, 2 weeks, *Trametes proteus*, 2 weeks.



PLATE 4.

- FIG. 1.—*Amauroderma rude*: (a) Advancing hypha. (b) Aerial hypha. (c) Fibre hyphae with swellings. (d) Wide hypha with thick walled fibre hyphae branching off. (e) Terminally inflated fibre hyphae from crustose areas.
- FIG. 2.—*Coniophora arida*: (a) Advancing hyphae with multiple clamps and whorl of branches from clamps. (b) Aerial hypha with multiple clamps. (c) Aerial hypha with simple and multiple clamps. (d) Submerged hypha.
- FIG. 3.—*Ganoderma colossum*: (a) Advancing and aerial hyphae. (b) Widened hyphae with simple septa and deeply staining contents. (c) Thin-walled narrow hyphae without clamps and few simple septa.
- FIG. 4.—*Lentinus sajor-caju*: (a) Advancing and aerial hyphae with clamps. (b) Fibre hyphae. (c) Chlamydospores. (d) Thick-walled, swollen hyphae from crustose layer. (e) Submerged hypha with chlamydospore.
- FIG. 5.—*Lenzites palisoti*: (a) Advancing and aerial hyphae. (b) Fibre hyphae. (c) Fibre hyphae with wide lumen at tips. (d) Oidia. (e) Chlamydospore. (f) Submerged hypha.
- FIG. 6.—*Polyporus arcularius*: (a) Advancing and aerial hyphae. (b) Fibre hyphae. (c) Thick-walled brown hyphae from skinlike areas. (d) Basidia and basidiospores.
- FIG. 7.—*Polyporus sanguineus*: (a) Advancing and aerial hyphae. (b) Fibre hyphae. (c) Chlamydospores. (d) Submerged mycelium with chlamydospores.
- FIG. 8.—*Polystictus hirsutus*: (a) Advancing and aerial hyphae. (b) Fibre hyphae. (c) Submerged hyphae. (d) Oidia. (e) Basidium and basidiospores.



## PLATE 4

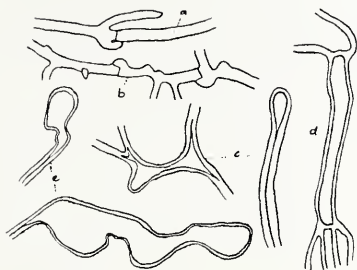


Fig. 1

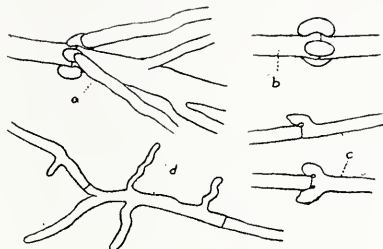


Fig. 2

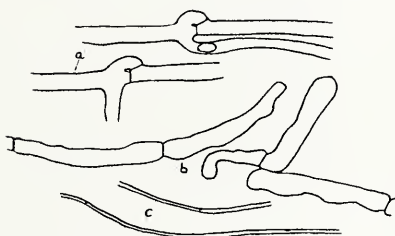


Fig. 3

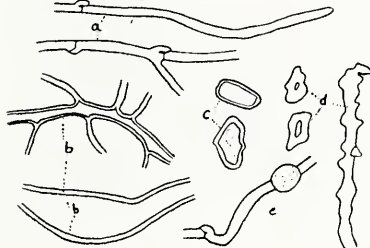


Fig. 4

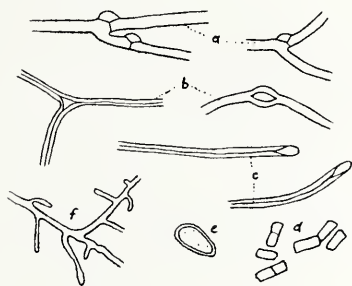


Fig. 5

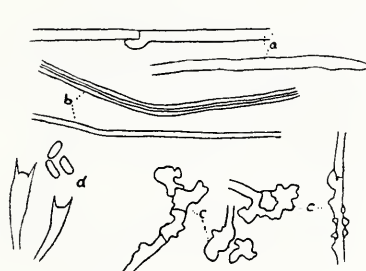


Fig. 6

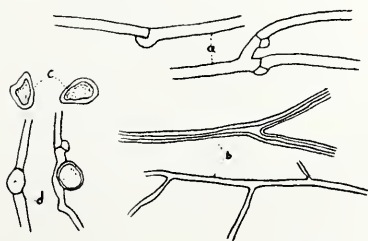


Fig. 7

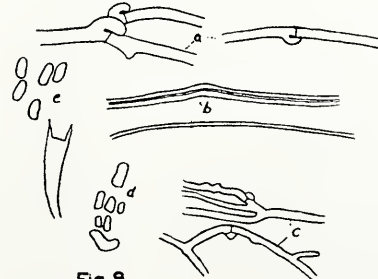


Fig. 8

PLATE 5.

- FIG. 1.—*Poria vaillantii*: (a) Advancing hyphae. (b) Aerial hyphae. (c) Wide irregularly distended hyphae. (d) Fibre hypha. (e) Basidia and basidiospores.
- FIG. 2.—*Schizophyllum commune*: (a) Advancing hypha. (b) Chlamydospores. (c) Hyphae with short, narrow side branches. (d) Submerged mycelium. (e) Basidia and basidiospores.
- FIG. 3.—*Stereum hirsutum*: (a) Advancing and aerial hyphae with multiple clamps. (b) Fibre hyphae. (c) Helicoid hyphae.
- FIG. 4.—*Stereum purpureum*: (a) Advancing hyphae. (b) Wide hypha from aerial mycelium. (c) Vesicular gloecystidia. (d) Basidia and basidiospores.
- FIG. 5.—*Stereum sanguinolentum*: (a) Advancing hyphae. (b) Wide hyphae with simple septa and paired clamps. (c) Helicoid hyphae.
- FIG. 6.—*Trametes cingulata*: (a) Advancing and aerial hyphae. (b) Fibre hyphae. (c) Chlamydospores. (d) Submerged hypha. (e) Basidia and basidiospores.
- FIG. 7.—*Trametes ineyenii*: (a) Advancing and aerial hyphae. (b) Fibre hyphae. (c) Submerged hypha. (d) Oidia.
- FIG. 8.—*Trametes proteus*: (a) Advancing hyphae. (b) Fibre hyphae. (c) Encrusted hypha. (d) Submerged mycelium. (e) Basidia and basidiospores.

## PLATE 5

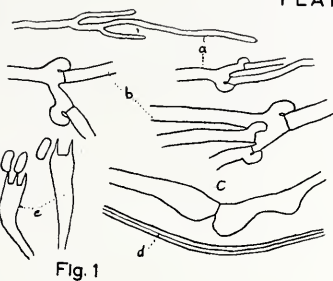


Fig. 1

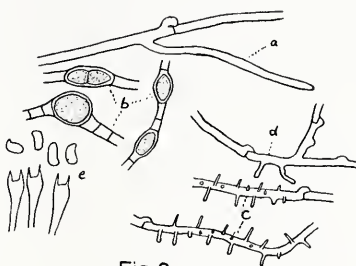


Fig. 2

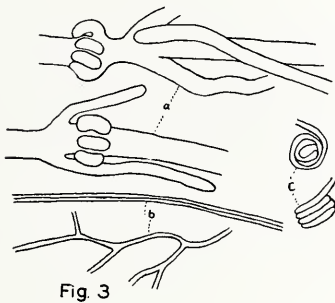


Fig. 3

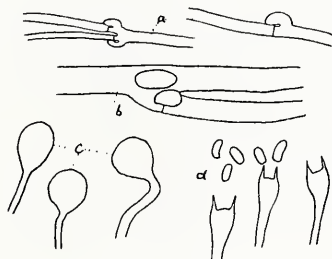


Fig. 4

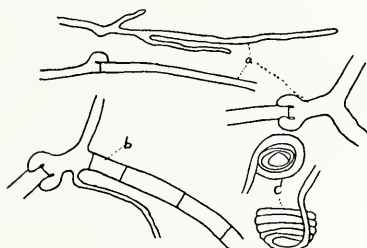


Fig. 5

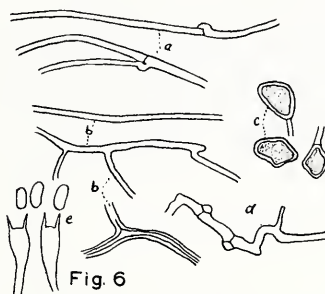


Fig. 6

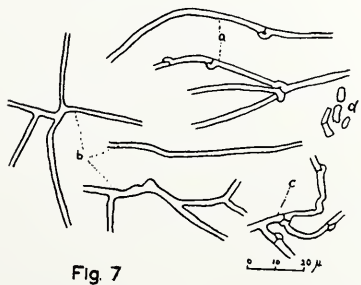


Fig. 7

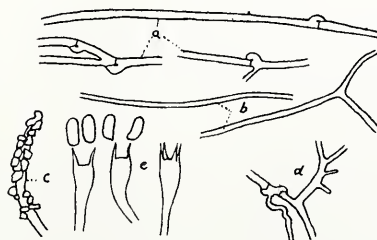


Fig. 8





# New and Interesting Records of South African Fungi. Part iii.\*

By

P. H. B. Talbot.

## 1. *Schizostoma laceratum* Ehrenb. ex Lev.

This species has previously been recorded only from equatorial Africa, Australia, India (Cunningham, 1944) and California (Lloyd, 1923). Mr. J. P. H. Acocks, who has a remarkable flair for finding rare Gasteromycetes, recently made a fine collection of twenty-two fructifications of this species on a sandy slope below Jan Swartsberg, 25 miles west of Williston, 30/vii/1956 (Acocks, A. 18917; PRE. 41592). The fungus was stated to be frequent in that locality.

The species is readily identifiable from Cunningham's description. Published photographs of the species show only one or two specimens, which are sometimes incomplete. Thus it seems desirable to publish the accompanying photograph (Fig. 1) which, in the original at least, gives a very good idea of the structure of this attractive and unmistakeable fungus.

The exoperidium is a sand-hyphal layer, fugitive except at the base. The endoperidium is umber brown, hard, papyraceous, polished, pitted, and dehisces by means of irregular splits from the apex downwards. The stipe, somewhat paler than the endoperidium, is socketed to the base of the peridium, and has a small semi-volvate mycelial pad at the base and also longitudinal striae and ill-defined appressed scales. The gleba is coloured deep umber with a purplish tinge. The capillitium threads are short, yellowish, non-septate, thin-walled, with characteristic short lateral branches with rounded ends. The spores are brown, smooth, subglobose, 4.5–6  $\mu$  diameter.

## 2. *Aseroë rubra* La Bill. ex Fries.

Although this species was described by Miss Bottomley (1948, p. 526), its occurrence in South Africa has hitherto been doubtful. The only known record was a specimen in Herb. Kew. collected by W. T. Saxton in Cape Town, which Miss Bottomley thought might have been confused with *Anthurus archeri*. It was therefore most interesting to receive indubitable specimens of *Aseroë rubra* collected by Mr. M. J. Howell in a plantation of *Acacia mollissima* at Otto's Bluff, Natal, on 2/ii/1957 (PRE. 41735), and again at Richmond, Natal, on 10/x/1957 (PRE. 41746). The first of these collections is illustrated in Fig. 3.

Miss E. L. Stephens informs me that 15 to 20 specimens of *A. rubra* were found growing close together on the farm Die Hoek, Swellendam C.P., by Miss D. Hermans and Mr. C. Steytler on 16/iii/1958 (Herb. E. L. Stephens No. 1845).

\* Parts I and II of this paper appeared in *Bothalia* 6 (1951) 183–204 and *Ibid.* 6 (1956) 489–500 respectively.

### 3. *Chlamydomys meyenianus* (Klotzsch) Lloyd.

There is only one previous record of this species for South Africa (Bottomley, 1948, p. 625), for which no details of locality and collector were available. The species has been found again by Mr. J. P. H. Acocks on the ground at Pampoenpoort, C.P., 29/x/1954 (Acocks, 17842; PRE. 41007). It is illustrated in Fig. 2.

### 4. *Battarea stevenii* (Liboschitz) Fries.

This species is well illustrated and described by Miss Bottomley (1948, p. 620) who examined several South African collections. Four unusually fine specimens emerged in the grounds of the Division of Botany, Pretoria, in October 1950, (leg. P. H. B. Talbot; PRE. 39098) and provided an opportunity to take the accompanying photograph (Fig. 4). This supplements Miss Bottomley's illustrations by showing clearly the nature of the gleba before dehiscence of the peridium. The specimens appeared on a roadside which had been filled in a few months previously with very hard soil containing large pieces of shale, which were lifted and pushed aside by the fungus as it broke through the surface. About half of the stipe was underground. The fungus has not been seen there since.

### 5. *Helicosporium aureum* (Corda) Linder.

This attractive species was collected by Dr. A. L. James on a beam of imported southern pine which had been stacked for sixteen months in the open at Brakpan Mines Ltd., 8/v/1952 (T.R.L. 2900; PRE. 41738). It is superbly illustrated by Linder (1929, p. 279).

The fungus forms an olive-yellowish, loose, cottony layer which is separable from the substratum. The conidiophores are erect, brown, septate, 300–400–(700)  $\mu$  in length and 6–7  $\mu$  wide at the base, tapering and becoming paler towards the apex. They are simple at first but later branch at right angles in the upper half to two-thirds of the conidiophore. Conidia are borne pleurogenously on hyaline bladder-like swellings, 6–9  $\mu$  long, which arise laterally on the lower part of the conidiophores. The conidia are hyaline to very pale yellowish, indistinctly multiseptate, coiled  $3\frac{1}{2}$  times in one plane. The coiled conidium is up to 22  $\mu$  in diameter and its filament is 1–2  $\mu$  wide.

Among the helicosporous fungi imperfecti this species is easily recognised by its erect brown conidiophores which branch above at right angles, and by its coiled conidia borne on terminal spicules of bladders which occupy the lower part of the conidiophore.

### 6. *Tilletia ehrhartae* sp. nov.

Sori nigri in ovariis *Ehrhartae calycinae*. Sporae verrucosae fuscae globosae vel subglobosae, 19–24  $\mu$  diam.; verrucae rotundae ad 1.5  $\mu$  altae. Typus PRE. 41604, leg. R. Story (6006).

Sori black, occupying the ovaries of *Ehrhartae calycina*; spores dark-coloured, globose to subglobose, 19–24  $\mu$  diam., including the verrucose epispore composed of rounded warts up to 1.5  $\mu$  high. Type R. Story (6006), on *Ehrhartae calycina*, Nature Reserve, Lambert's Bay, Clanwilliam distr., Oct., 1956.

Dr. M. B. Ellis of the Commonwealth Mycological Institute has favoured me by comparing this collection with the type of *Tilletia verrucosa* Cooke & Massee, the only other *Tilletia* yet reported on *Ehrhartae* (Zundel, 1953, p. 301). In *T. verrucosa* the spores are 20–24  $\mu$  diam. (including the warts); they are very much paler than those of *T. ehrhartae* and the warts are 3–4  $\mu$  long and acute at their tips. The contents of the sori are also much paler in *T. verrucosa*.

7. *Thecaphora bulbinellae* sp. nov.

Sori in floribus celati ovaria per dentes; Cumulus sporarum granulatus niger; Columella nulla; Glomeruli sporarum stabili fuscis subglobosis vel ellipsoideis, 24–54  $\mu$  diam., sporis 20 vel multis; Sporae globosae vel subglobosae vel ellipsoideae vel nonnihil angulatae, (4·6)–7·7–12·3  $\mu$  maximo diametro, leves fuscae crasse tunicatae; Epispora crassitudine 0·5–1·5  $\mu$ .

Sori enclosed by the flowers and destroying the ovaries. Spore mass granular, black. Columella absent. Spore-balls permanent, brown, subglobose to ellipsoid, 24–54  $\mu$  diam., containing from 20 to numerous spores. Spores firmly united, globose, subglobose, ellipsoid or somewhat angular, (4·6)–7·7–12·3  $\mu$  in greatest diameter, yellow-brown to reddish-brown, thick-walled, the epispora 0·5–1·5  $\mu$  thick, smooth on both the united and free faces of the spores. On Liliaceae: Type PRE. 41745, leg. J. Toxopeus on *Bulbinella setosa* (Willd.) Dur. & Schinz, Struben's Valley, Pretoria, 24/vi/57.

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 ZUNDEL, G. L. .... (1953). *Ustilaginales of the World*, p. 301.





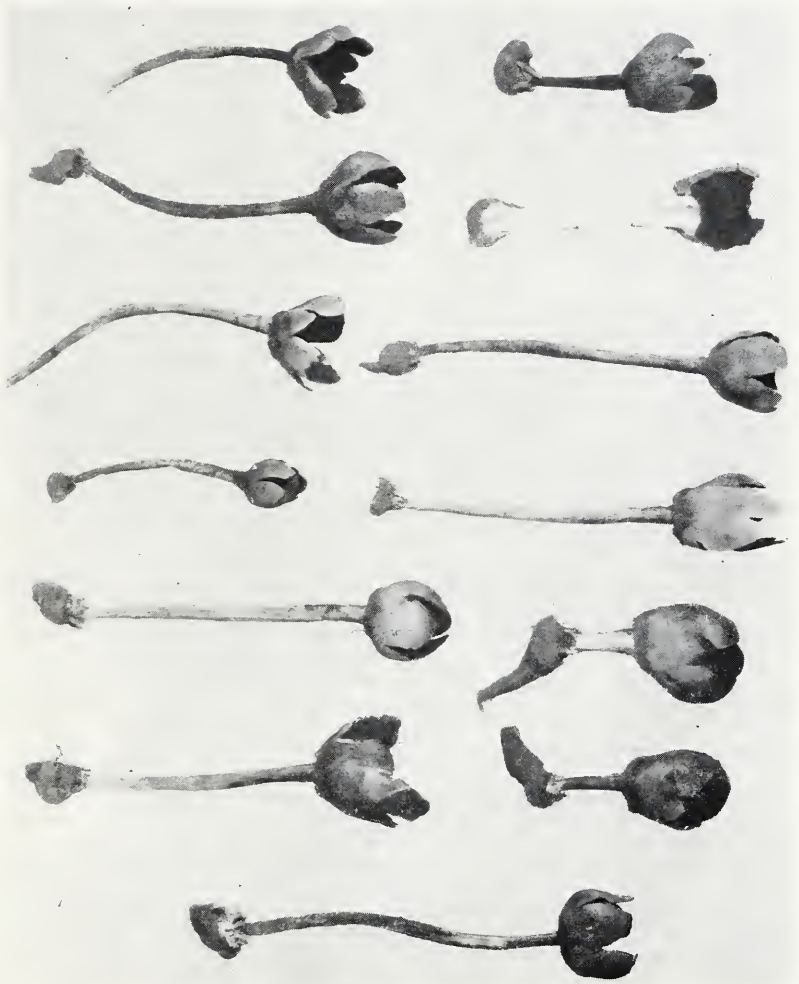


FIG. 1.—*Schizostoma laceratum*  $\times 5/6$ .

[Photo: H. King.]



Above: FIG. 2.—*Chlamydopus meyenianus*  $\times 1$ .

[Photo: J. Reyburn.

Below: FIG. 3.—*Aseroë rubra*  $\times 1$ .

[Photo: J. Reyburn.



FIG. 4.—*Battarea stevensii*  $\times 1/2$ .

[Photo: H. King.]





# The Genera *Craterellus*, *Cymatoderma* (*Cladoderris*) and *Thelephora* in South Africa.

By

P. H. B. Talbot.

## CRATERELLUS Persoon.

1. *Craterellus cornucopioides* (Linn. ex Fr.) Pers., Myc. Eur. 2 (1825) 5; Doidge in Bothalia 5 (1950) 483.

*Peziza cornucopioides* Linn., Sp. Plant. (1753) 1181.

*Cantharellus cornucopioides* Linn. ex Fr., Syst. Myc. 1 (1821) 321.

### FIG. 1.

Fructifications single or caespitose, about 4.5 cm high and 2.5 cm diam. at the apex, thin, membranous, drying brittle, trumpet-shaped, tapered to the base, hollow to the base of the stipe. Hymenium on the outer side, cinereous when moist, drying brownish to yellow-brown and black at the base, smooth, becoming longitudinally wrinkled, subgelatinous, drying corneous. Abhymenial surface deep smoky brown, becoming almost black, squamulose. Margin often darker than the rest, usually curved downwards, sometimes erect, lobed. Stipe hollow, black, smooth, glabrous, up to 5 mm diam.

Basidia: long clavate or subcylindrical,  $6-9 \times 50-70 \mu$ , with 2-4 sterigmata.

Spores: hyaline, smooth, elliptic-oblong, with a small lateral apiculus,  $6.5-8-(9.6) \times 12-14-(16.5) \mu$ .

Specimens examined: 10456 (J. M. Wood, 4108), *J. Blake*, Harrison, Natal.

This is the only species of the genus to have been recorded in South Africa, and the above specimen is the only one yet found. The basidia and spores were clearly seen and were quite typical of this species. Other microscopic characters were indistinct.

The systematic position of *Craterellus* is likely to remain speculative until the Aphyllophorales have been more critically examined by hyphal analysis and by comparison of other microscopic features. A recent view of *Craterellus* is to place it in the Cantharellaceae (Singer in Lilloa 22, 1949, 730), a family supposedly related rather to the Clavariaceae than to the Agaricaceae or Thelephoraceae where it has formerly been classed.

I have here considered *Craterellus* with the Thelephoraceae because it has been so recorded in previous South African literature and because my present object is to examine the validity of these specific and generic records.

## CYMATODERMA Jungh.

The name *Cladoderris* Pers. ex Berk., a later synonym of *Cymatoderma* Jungh., has almost exclusively been used for this genus in the past, and was proposed for conservation against *Cymatoderma* (Donk in Bull. Bot. Gard. Buitenzorg ser. iii, 18, 1941, pp. 156 and 163). This proposal was defeated at Congress (Taxon 2, 1953, 31). The type species of the genus is *Cymatoderma elegans* Jungh.

The little that is known of the genus is mainly summarised in Fries' "Fungi Natalenses" (1848) and in Lloyd's "Synopsis of the Genus *Cladoderris*" (Lloyd Myc. Writ. 4, 1913).

*Cymatoderma* is evidently closely related to *Stereum*, especially through such species as *Stereum involutum* (Klotzsch) Fr., but differs from *Stereum* in the possession of a radially ribbed and usually papillate hymenium. With the exception of *Cladoderris funalis*, the species of *Cladoderris* or *Cymatoderma* are rather uniform in microscopic characters, having a dimitic hyphal system, hyaline spores, and usually cystidia and/or gloecystidia showing respectively little variation from species to species. But macroscopically the species are bewilderingly variable. The specific distinctions have always been based almost entirely on the external appearance without adequate investigation of the microscopic features and without sufficient regard for the natural variations and intergradations that are possible in such characters as hairyness, colour and habit. Owing to variation these characters are undoubtedly of minor importance and the emphasis laid on them originally resulted in an unnecessary number of species being proposed. Recognising this fact to some extent, Lloyd was able to accept only five 'good' species out of some twenty-five that had already been described. Lloyd noted that the mode of insertion of the stipe was of no specific value, and stated that the characters of value were: (1) the nature of the hymenial folds, whether broad and obtuse or narrow and sharp, (2) the presence or absence of papillae (but then admitted that these were not a constant feature), and (3) the tomentose upper surface, whether densely or scantily clothed with hairs.

It is instructive to quote fairly extensively from Lloyd's comments on some of the species which he differentiated, which show clearly that the above characters are actually of little taxonomic value owing to variation and intergradation, and secondly that any attempt to key out species entirely on such characters is likely to fail:—

\**Cladoderris dendritica*: "Papillae usually none, but many specimens occur with a few." . . . "I believe that . . . *C. elegans* is in reality only an excessively warty form (of *C. dendritica*) for while the type forms are so different (apparently) there are many connecting specimens in the museums."

\**Cladoderris elegans*: "As to colour, variation as to form and stipe characters, and very often as to the even, thick tomentum pad on the pileus, *elegans* is similar to *dendritica*, but *elegans* has the narrow folds of the hymenium densely covered with papillae" . . . "And the hymenium folds, while narrow, are more the nature of those of *Cladoderris spongiosa*, and specimens occur connecting it with *spongiosa*, rather than with *dendritica*."

\**Cladoderris spongiosa*: "Nor is the distinction between it and *Cladoderris elegans* strongly marked, for the nature of the (hymenial) folds is not an absolute character, and many specimens occur that appear to be intermediate."

\**Cladoderris infundibuliformis*: "All the preceding species might be broadly considered as forms of the same species, but this is widely different, in having a darker colour, thin, ridged pileus, slight tomentum" . . . "Usually the tomentum is but slightly developed, or almost none, but it is a varying character as shown in specimens at Kew of the same collection."

TABLE 1.

Microscopic organs of various species of *Cymatoderma* (*Cladoderris*): Measurements in  $\mu$ .

Species.	Cystidia.	Gloeocystidia.	Spores.	Hairs.	Hyphae.
<i>C. elegans</i> .....	14-17 $\times$ 35-45	6-11 $\times$ 35-55	3.2-3.7 $\times$ 6.5-8.3	3-5	3-5; dimitic.
<i>C. spongiosa</i> ...	9-14 $\times$ 20-50	9-13 $\times$ 28-55	3.2-4.8 $\times$ 6.4-9.5	4-6	3-6; dimitic.
<i>C. australica</i> ...	6.6-13 $\times$ 20-40	9-12 $\times$ 25-60	3.2-5.0 $\times$ 6.4-9.6	4-6	2.5-5; dimitic.
<i>C. infundibuliformis</i> .....	9-15 $\times$ 25-40	8-15 $\times$ 30-45	3.3-4.0 $\times$ 6.7-8.6	4-5	3-5; dimitic.
<i>C. dendritica</i> ...	Nil.	8-13 $\times$ 30-75	3 $\times$ 4 or 3-4 diam.	5-6	3-7; dimitic.
<i>C. funalis</i> .....	Nil.	Nil.	4.8-6.4 $\times$ 6.4-8.0	3-5	3-9; monomitic.

The taxonomy of this genus must undoubtedly be based primarily on microscopy (see Table 1; cfr. Figs. 2-7). If this is done, *C. dendritica* may be separated from the other species mentioned above by its distinctively smaller and rounder spores and by its lack of cystidia, features mentioned also by Burt (in Ann. Mo. Bot. Gard. 11, 1924, 3). All the other species quoted above have spores, cystidia and gloeocystidia of essentially the same size and shape respectively, and cannot be separated microscopically. The precise configuration of the hymenium, as Lloyd showed, is variable and intergrades, and in any case this character has frequently been demonstrated as unreliable in taxonomy. The development of the surface hairs varies considerably in specimens of a single collection, and hairs may easily rub off with age or be destroyed by insects. The thinner pileus and darker colour of *C. infundibuliformis* is mainly due to the fact that the hairs are scanty. If the hairs be removed from a specimen of *C. spongiosa*, the surface is seen to be dark in colour and composed of radiating, acute ridges not essentially different from *C. infundibuliformis*. To the writer only one macroscopic character so far appears to be of definite specific value, namely whether as in *C. funalis* P. Henn. the pileus is deeply dissected into narrow radiating segments. But as will be seen later, this species is probably better referred to the Clavariaceae under *Clavulina* or *Aphelaria*.

The species that have been studied may be grouped as follows:—

- (A) Pileus deeply dissected into narrow radiating segments. Hyphae monomitic. Cystidia and gloeocystidia absent. Basidia bisporous to quadrisporous. Spores 4.8-6.4  $\times$  6.4-8  $\mu$ . *C. funalis*.  
Pileus entire to shortly incised or lacinate at the margin. Hyphae dimitic. Cystidia and/or gloeocystidia present (B).
- (B) Gloeocystidia present, cystidia absent. Spores  $\pm$  subglobose, 3  $\times$  4  $\mu$  or 3-4  $\mu$  diam. *C. dendritica*.  
Both gloeocystidia and cystidia present. Spores ellipsoid, 3-5  $\times$  6-10  $\mu$ .  
The *C. elegans* Complex (C).
- (C) Pileus surface densely covered by a thick, whitish, pad-like tomentum.  
(a) Hymenial ribs narrow *C. elegans*.  
(b) Hymenial ribs broad, obtuse *C. spongiosa*.  
Pileus surface scantily tomentose, light red-brown or yellow-brown. *C. infundibuliformis*.  
Pileus surface almost devoid of hairs when mature, and dark red-brown to fuscous in colour. *C. australica*.

This last group of four names (the *C. elegans* Complex) has been subdivided above in accordance with the old concept of the species concerned, where extremes in macroscopic form were recognised. But there is little doubt that all these species are variations of a single species, whose earliest epithet is *elegans*, and that the variations intergrade so much that it would not be practicable to recognise varieties of *C. elegans* based on those macroscopic features. I propose therefore that *C. spongiosa*, *C. infundibuliformis*, and *C. australica* should be regarded as synonyms of *C. elegans* Jungh.

#### Notes on South African Records of *Cymatoderma* (Cladoderris).\*

The species of *Cymatoderma* and *Cladoderris* that have been recorded for South Africa will now be reviewed. Accepted species are printed in bold type, synonyms or dubious records in italics. I am much indebted to the Director of the Royal Botanic Gardens, Kew, and to the Director of the South African Museum, Cape Town, for the loan of some specimens. I wish also to record my thanks to Mr. D. A. Reid of Kew Herbarium for helpful discussion of some of the problems involved.

##### 1. *Cladoderris australis* Kalchbr. f. *minima* Bres.

There is a specimen in Kew labelled "*Cladoderris australis* Kalchbr. f. *minima*. Specimen authenticum", in Kalchbrenner's writing. The word "Cape" and Bresadola's signature also appear on the label. Although I have not been able to trace whether Bresadola ever published his f. *minima*, and it is probably only a herbarium name, yet this specimen requires comment in view of the similarity of the epithets of *C. australis* and *C. australica* and another species *Cladoderris minima* C. & Br.

The specimen is not a *Cymatoderma* but instead a good match with *Stereum thozettii* Berk. According to Lloyd (Syn. Stip. Stereum 1913, 28) a specimen which he assumes to be the original of *C. australis* Kalchbr. is *Stereum elegans* Mey.

##### 2. *Cymatoderma elegans* Jungh. in Tijdschr. Nat. Gesch. Phys. ed v. d. Hoeven & De Vriese 7 (1840) 390; Montagne in Ann. Sci. Nat. 7 (1847) 173.

*Cladoderris elegans* (Jungh.) Fries, Fungi Natalenses (1848) 22; Doidge in Bothalia 5 (1950) 480.

*Cladoderris spongiosa* Fries (!), Fungi Natalenses (1848) 20; Saccardo, Syll. Fung. 6 (1888) 548; Lloyd, Syn. Gen. Cladoderris (1913) 5, f. 526; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 51, f. 17; Doidge in Bothalia 5 (1950) 480.

*Cladoderris spongiosa* Fr. var. *subsessilis* Fr., Fungi Natalenses (1848) 21; Doidge in Bothalia 5 (1950) 480.

*Actinostroma infundibuliforme* Klotzsch, Fungi in Meyen, Beiträge zur Botanik, gesammelt auf einer Reise um die Erde (1843) 237.

*Cladoderris infundibuliformis* (Kl.) Fries, Fungi Natalenses (1848) 21; Doidge in Bothalia 5 (1950) 480.

*Cladoderris australica* Berk. ex Saccardo, Syll. Fung. 6 (1888) 548; Cooke, Handbk. of Australian Fungi (1892) 181, f. 76; As *C. australica* Berk. in Herb., Cooke in Grevillea 8 (1879) 70, *nom. nud.*; *ibid.* 9 (1880) 14, *nom. nud.*; *ibid.* 11 (1882) 28, *nom. nud.*

FIGS. 2, 4-6.

\* Deur die goedgunstigheid van die Universiteit van Stellenbosch is ek toegelaat om sekere eksemplare in die Herbarium P. A. van der Byl te ondersoek. Verwysing na verskillende soorte in die Van der Byl-Herbarium word hieronder gemaak.



Pileus flabellate to infundibuliform, substipitate or attached by a short central, excentric or lateral stipe. Surface radially ridged, the ridges sharp, sublamellate, varying from nearly glabrous and somewhat zonate to thickly covered with a dense whitish, later discoloured, pad-like tomentum and azonate; the ridges yellow-brown to light reddish-brown to dark red-brown (near Carob brown or Chestnut of Ridgway). Margin entire or slightly incised. Hymenium creamy to light buff, radially costate, the ribs varying from narrow and sharp to broad and obtuse, almost smooth or strongly papillate or tuberculate.

Basidia: Clavate,  $25-45 \times 6 \mu$ .

Spores:  $3.2-5 \times 6.4-9.6 \mu$ , hyaline, smooth, elliptical, sometimes unilaterally depressed.

Cystidia: smooth, rarely with a minutely encrusted apical portion, hyaline, very thick-walled, fusiform, mammiform or pyriform, often with a small apical protuberance,  $(6.6)-8-17 \times 20-50 \mu$ , terminal in position.

Gloeocystidia: smooth, hyaline, with homogeneous deeply-staining contents, fusoid, pyriform or mammiform, or sometimes elongated and irregularly subcylindrical,  $(6)-8-12-(15) \times 25-60 \mu$ .

Hyphae: dimitic, hyaline. Skeletal hyphae thick-walled, smooth,  $2.5-6 \mu$  diam.

Surface hairs: scanty to abundant, thick-walled, smooth, hyaline, with clamp connections, part of the generative hyphal system.

Specimens examined: As *C. elegans*: Herb. Hort. Bot. Bog. Java 2361 in Herb. Kew.; *P. W. Richards* 2258, Sarawak, in Herb. Kew. (Java is the *locus typicus* of this species). As *C. spongiosa*: Part of Type in Herb. Kew. marked by Fries " *Cladoderris spongiosa* Fung. Nat. fragmentum Cap. Nat."; *Farquharson* 47, S. Nigeria, in Herb. Kew.; Universiteit van Stellenbosch, Herbarium P. A. van der Byl nr. 319, 2085; National Herbarium, Pretoria Nos. 36864, 33142, 15554, 31344, 9149, 39079. As *C. infundibuliformis*: *Dümmer* 2108 and 3125, Uganda, in Herb. Kew.; Ex Papua, det E. M. Wakefield, in Herb. Kew.; *W. Small*, 471, Uganda; *Maitland* 1, 30 A, Uganda; *Holst* 2542, Usambara; National Herb., Pretoria No. 18045 and 13032 (*Dümmer* 2108), Uganda; Universiteit van Stellenbosch, Herbarium P. A. van der Byl nr. 522. As *C. australica*: *J. M. Wood* 239, Natal (In Herb. Kew. and in Herb. S.A. Museum No. 34303) neotype. As *Thelephora dendritica*: ex Gripps Land, Herb. Berkeley.

Under *Cladoderris elegans*, Doidge lists two collections by Drège from South Africa. It has been ascertained that neither of these is represented in Montagne's Herbarium in the Paris Natural History Museum.

*Cladoderris spongiosa* Fr. var *subsessilis* Fr. was described as having an excentric stipe, but, as Lloyd has shown, the characters of stipe insertion are not of taxonomic value in this genus.

There is a specimen in Herb. Kew. labelled "*Thelephora calix* Kze." in an unknown handwriting, and "*Thelephora dendritica* Fr. Africa austr. leg. Ecklon & Zeyher" by Berkeley. It corresponds with *Cladoderris spongiosa* microscopically, and macroscopically except that its hymenium is obviously discoloured.

*Cladoderris australica* Berk. ex Sacc. is a species with a curious and complicated history. Cooke first published this name in 1879, 1880, and 1882 as a *nomen nudum*, attributing the epithet to "Berk. in Herb." In 1888 Saccardo validated the name with a full description, citing it as "*Cladoderris australica* Berk. in Herb. et in Cooke Fungi Austral." The formal citation of this species should therefore be *Cladoderris australica* Berk. ex Sacc. Then in 1892 Cooke published a close translation of Saccardo's description and added a coloured figure. He cited the species as "*Cladoderris australica* Berk. in Herb.", and referred to Saccardo's description. There is no concrete evidence that Berkeley ever used *C. australica* as a herbarium name, but both Saccardo and

Cooke referred to a Berkeley specimen from New South Wales which, if it existed, would be the holotype. The only Berkeley specimen in the type folder of *C. australica* at Kew was labelled "*Thlephora dendritica*" by Berkeley, and came from Gipps Land. Gipps Land is now part of Victoria, but I am informed by Mr. D. A. Reid that prior to 1851 it formed part of New South Wales. The old boundaries would be difficult to define and no exact locality was given for this specimen, so one could perhaps accept this specimen as being the one from N.S.W. referred to by Saccardo and by Cooke. Berkeley, on the other hand, did not use the name *C. australica* for this specimen, and so one must assume that he used it for a specimen that is now lost; consequently a lectotype or neotype should be chosen. As there is no material in existence seen and classified by Berkeley as *C. australica* a lectotype is out of the question and a neotype should be nominated. Cooke's earlier mention of the species was in connection with the Natal collection of *J. M. Wood* No. 239, and there is little doubt that both Saccardo's and Cooke's descriptions, and the coloured figure, fit the Natal specimens rather than Berkeley's specimen from Gipps Land. Lloyd (Syn. Gen. *Cladoderris* 1913, 10) considered that the latter specimen matched *C. spongiosa* Fr., and I support that opinion. Consequently I consider that if another Berkeley specimen, now lost, had existed, it must have had the appearance of *J. M. Wood* 239, and I nominate the latter as the **neotype** of *Cladoderris australica* Berk. ex Sacc. I regard both *C. spongiosa* and *C. australica* as synonyms of *Cymatoderma elegans* Jungh. That a neotype for *C. australica* should be nominated, really only becomes a practical necessity if this synonymy should later be disputed.

It may be mentioned that the specimen of *J. M. Wood* No. 239 in the National Herbarium, labelled *Cladoderris thwaitesii*, is instead a species of *Favolus*, but that the part of this collection in Herb. S.A. Museum 34303 matches *Cladoderris australica* and the neotype in Kew.

3. *Cladoderris fimalis* P. Henn. in Engler Jahrb. 38 (1905) 120; Saccardo Syll. Fung. 21 (1912) 385; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 52, f. 18; Doidge in Bothalia 5 (1950) 480.

#### FIG. 7.

Fructifications laterally stipitate, anastomosed and with somewhat fused stipes, more or less flabellate, 3 cm diam. and 1.5 cm high. Stipe 1.5–2 cm × 2 mm, compressed, rugulose striate. Upper surface sterile, yellow-brown to pale reddish-brown, covered with tangled, thick, colorless fibrils composed of fascicles of hyphae. Margin fimbriate to deeply dissected. Hymenium yellowish to brownish, covering broad, obtuse, radiating, branched ribs, not papillate, decurrent on the stipes.

Basidia: cylindric-clavate,  $35\text{--}50 \times 6\text{--}8\ \mu$ , with two to four sterigmata up to  $4\ \mu$  long.

Spores: hyaline, smooth, ovate to ellipsoid, finely apiculate,  $4.8\text{--}6.4 \times 6.4\text{--}8\ \mu$ .

Hyphae: thin-walled, hyaline, without clamps, septate, readily collapsing, in parts inflated,  $3\text{--}9\ \mu$  wide. Hyphae composing the surface fibrils are similar, usually uninflated,  $3\text{--}5\ \mu$  wide, adherent in fascicles.

Specimens examined: Universiteit van Stellenbosch, Herbarium P. A. van der Byl nr. 2465 (*Eyles* 5026), Salisbury, S. Rhod.

This collection agrees very well with Hennings' description and Lloyd's photograph (Syn. Gen. Clad., 1913, p. 10, Fig. 530) of the type, and appears to be correctly named as to species.

The dissection of the pileus at the margin is partly due to the running out of the hymenial ribs, and partly to their being continued into some of the surface fibrils. The fibrils are thick, sterile, and resemble hydroid spines. The hymenial ribs are broad, obtuse and not papillate. The spores are very abundant. No cystidia or other accessory organs are present. There is a monomitic hyphal system.

Writing of *Cladoderris funalis*, Lloyd said, "It is so different from all other species that it is a question if Hennings was correct in referring it to *Cladoderris*." Lloyd suggested an affinity with *Laclmocladium*, but that can be ruled out since *C. funalis* has no dichophytic hyphae.

Certainly *C. funalis* is far removed from other *Cladoderris* species by its monomitic hyphae which become inflated, by its bisporous to quadrisporous basidia, and by the lack of cystidia and gleocystidia. It seems certain that the ribbed hymenium is composed basically of flattened clavarioid branches which have fused into an unusual dorsiventral form. Except that the basidia are not all bisporous they and the other microscopic characters agree well with those of *Clavulina* as delimited by Corner (Monogr. of Clavaria and Allied Genera, 1950), and there are species in this genus which show flattened branching. Flattened branching is however more characteristic of the genus *Aphelaria* Corner in which the basidia are bisporous to quadrisporous; but the hyphae in *Aphelaria* are uninflated and tend to have thickened walls, which is not the case in *Cladoderris funalis*. Mr. D. A. Reid informs me that the type of *C. funalis* has basidia with four spores. *Cladoderris funalis* appears to have characters somewhat intermediate between those of *Clavulina* and *Aphelaria* but I am not in a position to decide to which of these genera it should be transferred.

4. *Cladoderris thwaitesii* Berk. & Broome; recorded by Kalchbrenner in Grevillea 10 (1881) 58; Saccardo Syll. Fung. 6 (1888) 550; Doidge in Bothalia 5 (1950) 480.

The collection which Kalchbrenner assigned to this species is J. M. Wood No. 239. This collection has been nominated above as the neotype of *Cladoderris australica* Berk. ex Sacc., which has here been reduced to synonymy under *Cynatoderma elegans* Jungh.

According to Petch (Ann. Roy. Bot. Gard. Perad. 9, 1924, 134) the true *C. thwaitesii* is a bleeding species of *Stereum*.

### THELEPHORA Ehrhart ex Fries.

Many of the Thelephoraceae were originally described as species of *Thelephora* and have since been combined under other genera. The object of this section is to annotate all those species which have at some time been recorded for South Africa under the genus *Thelephora*.

1. *Thelephora (leijostroma) acerina* (Pers.) Pers. ex Fr., Syst. Myc. 1 (1821) 453; Persoon, Syn. Fung. (1801) 581, Myc. Eur. 1 (1822) 152; Léveille in Ann. Sci. Nat. ser. iii, 5 (1846) 150.

*Stereum acerinum* (Pers. ex Fr.) Fr., Epicrisis (1838) 554; Saccardo Syll. Fung. 6 (1888) 587.

As no material supporting Léveille's and Saccardo's records is available, it is not known whether this species is represented in South Africa. The species is referable to the genus *Aleurodiscus*, and a description and comment on it as a South African record is given by the writer (Bothalia 6, 1956, 466).

2. *Thelephora biennis* Fries, Syst. Myc. 1 (1821) 449; recorded by Kalchbrenner in Grevillea 10 (1881) 58.

This record is based on Kalchbrenner's determination of *MacOwan* (1244), collections of which have been examined at Kew Herbarium and in Herb. S.A. Museum (sub. *Stereum fuscum*, No. 34292). These specimens are *Stereum bicolor* (Pers. ex Fr.) Fr. Cfr. Bothalia 6 (1954) 308, f. 21.



3. *Thelephora (Stereum) fulva* L  veille (!) in Ann. Sci. Nat. ser. iii, 5 (1846) 149.

The type of this species, Dr  ge (9441), Cap-de-Bonne-Esp  rance in Herb. Mus. Paris, was examined and is annotated under *Stereum fulvum* (Lev.) Sacc: See Bothalia 6 (1954) 315, f. 20.

4. *Thelephora fuscoviolascens* Mont. in Ann. Sci. Nat. ser. iii, 7 (1847) 174.

Collected by Dr  ge (9429) at Port Natal, and referable to *Hymenochaete fuscoviolascens* (Mont.) Sacc., according to van der Byl (in Ann. Univ. Stellenbosch 7, 1929, 14). Saccardo (Syll. Fung. 6, 1888, 546) however, left the species under *Thelephora*, only suggesting in a footnote that it might be a *Hymenochaete*. The correct citation is thus *Hymenochaete fuscoviolascens* (Mont.) v. d. Byl as indicated by Doidge, loc. cit. p. 484. Dr  ge's specimen has not been available for personal study.

5. *Thelephora hirsuta* (Willd.) Pers. ex Fr.; Recorded for South Africa by Berkeley in Hooker Lond. Journ. Bot. 11 (1843) 516.  
= *Stereum hirsutum* (Willd.) Pers. ex S. F. Gray; annotated in Bothalia 6 (1954) 316, f. 11.

6. *Thelephora intybacea* Pers. ex Fr.; Recorded by van der Byl in Trans. Roy. Soc. S. Afr. 10 (1922) 285 and in Ann. Univ. Stellenbosch 7 (1929) 32; Doidge in Bothalia 5 (1950) 495.

The writer has examined van der Byl's specimens determined as this species in Universiteit van Stellenbosch, Herbarium P. A. van der Byl Nos. 214, 922, 1261, 1263. These are apparently indistinguishable from numerous South African collections named *Thelephora terrestris* in the National Herbarium, and from Herb. S.A. Mus. No. 34298, originally named *Thelephora laciniata* but annotated by v. d. Byl as *T. intybacea*.

The literature on *T. intybacea* does not clearly indicate how it differs from *T. terrestris* and moreover there is the complication that *T. intybacea* Pers. ex Fr. and *T. intybacea* Fr. are apparently not the same species. This confusion can obviously not be resolved outside Europe, but the probability is strong that *T. intybacea* does not occur in South Africa and that specimens recorded as such are actually the far commoner species *T. terrestris*. That opinion is adhered to here, and van der Byl's specimens are taken to be *T. terrestris*.

7. *Thelephora laciniata* Pers. ex Fr.; Recorded for South Africa by MacOwan in Cape Agric. Journ. 8 (1895) 331; Davidson in Natal Agric. Journ. 12 (1909) 617; Doidge loc. cit. p. 495.

*Thelephora laciniata* is generally acknowledged to be a synonym of *T. terrestris* Ehrh. ex Fr. Davidson's specimen does not exist, but I have seen MacOwan's (No. 1445, Herb. S.A. Mus. 34298) which is in no way different from *T. terrestris*.

8. *Thelephora palmata* (Scop.) Fr., Syst. Myc. 1 (1821) 432; Wood in Rept. Natal Bot. Gard. & Colonial Herbarium for 1898, p. 19; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 31; Doidge in Bothalia 5 (1950) 495.

This record is based on a single collection, in Herb. Kew., labelled "*J. M. Wood* (3497), *Thelephora palmata*, on ground in N.B. Gardens, Febr. 1885." The pilei are terrestrial, erect, flabelliform, and split longitudinally for about half their length into a number of flattened, narrow segments. The undivided base and the microscopic structure show that these segments are merely formed by splits in the fibrous pileus and are not clavarioid branches arising from a stem as is the case in *T. palmata*. Spores and basidia were absent, the only clear microscopic feature being the hyphae, which were pale coloured, lacking clamps, 2.5-3.2  $\mu$  diam., with thin or slightly thickened



walls. Both surfaces of the pilei were heavily covered with conidiophores and conidia of an *Aspergillus*. It is doubtful whether this collection is in good enough condition ever to be determined, but certainly it is not *Thelephora palmata*.

9. *Thelephora pedicellata* Schw.; Recorded by Wood in Rept. Natal Bot. Gard. & Colonial Herbarium for 1898, p. 19; Bottomley in S.A. Journ. Sci. 13 (1917) 440.

J. M. Wood recorded this fungus as "*Thelephora pedicellata* Schuz. (sic), on bark, No. 532." This collection was examined in Herb. Kew. and proved to be a species of *Septobasidium*, but could not definitely be referred to *S. schweinitzii* Burt (in Ann. Mo. Bot. Gard. 3, 1916, 324; Couch, The Genus *Septobasidium*, 1938, 112) with which *Thelephora pedicellata* Schw. is synonymous.

10. *Thelephora penicillata* Lloyd (non Fries) in Myc. Notes 6 (1920) 989, Figs. 1759, 1760; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 32, f. 12; Stevenson & Cash in Bull. Lloyd Library 35 (1936) 60; Doidge in Bothalia 5 (1950) 495.

FIG. 8.

Fructifications beginning as resupinate, fertile, membranous, whitish growths encrusting soil and debris, finely pubescent under the lens, smooth, following the conformation of the substratum, later becoming greyish then fuscous-purplish and finally drying fawn or chocolate brown. Flabellate fascicles of subulate radiating branches are emitted usually near the margin; they are oblique or suberect and become fertile with age at the base, white at first, then yellow-brown to fawn or chocolate brown with the apex remaining whitish and infertile. These branches are occasionally entire but are usually dissected into a number of penicillate or ciliate parts, and are up to 0.5–0.7 cm long. When growing on debris the fructification may become subpileate, but it is resupinate on soil. Microscopically the resupinate and pileate parts are the same.

Basidia: (30)–60 × 8.5–11  $\mu$ , proliferating by basal clamps, with four sterigmata up to 7.2 × 1.6  $\mu$ .

Spores: forming a chocolate coloured spore print, yellow-brown under the microscope, finely warted, irregularly angled, elliptic or subglobose, 4.8–7.2 × 6.4–9.6  $\mu$ .

Hyphae: at first hyaline, some later becoming dark brown, branched, closely intertwined, septate, with abundant clamps, 3.5–7  $\mu$  diam.

Specimens examined: 31417, *J. D. Krige*, Stellenbosch, June, 1919, (presumed Type collection); 31500, *A. V. Duthie*, Stellenbosch, July, 1923; 40512, *P. H. B. Talbot*, on soil and mosses, Fountains, Pretoria, 1951; 40712, *P. H. B. Talbot*, on soil and pine needles, Union Buildings Grounds, Pretoria, 1954.

This rather rare species inhabits very moist situations, especially favouring debris under pine trees but not confined to this habitat.

Lloyd (l.c.) named the earlier specimens from Stellenbosch *Thelephora penicillata*, about which Stevenson & Cash commented: "Seems to have been intended by Lloyd as a new species though his description and comparison with *T. spiculosa* Fr. might indicate that he had reference to *T. penicillata* Fr., Syst. Myc. 1, 434, 1821. In a note with a specimen of another species Lloyd refers to *T. penicillata* 'which I had named from South Africa.'"

Van der Byl and Doidge both attributed the specific epithet to Lloyd. If this is correct then it is a later homonym of *T. penicillata* Fr., and Lloyd's name has no nomenclatural standing. Lloyd regarded the South African specimens as differing from *T. spiculosa* Fr. in having the hymenium only on the resupinate portion and not on the erect subulate parts. However, further specimens show quite clearly that at least the basal parts of the penicillia become fertile with age.

From the literature alone there is very great difficulty in differentiating between *Thelephora mollissima* Pers. ex Fr., *T. spiculosa* and *T. penicillata*, for these names have been used in different senses by different authors. However, it seems fairly certain that our material is referable to the species described by Burt (Ann. Mo. Bot. Gard. 1, 1914, 225, Pl. 4, f. 2), after reference to an authentic specimen, as *T. spiculosa* Fr., and by Bourdot & Maire (in Bull. Soc. Myc. de Fr. 36, 1920, 29) as *T. spiculosa* Fr. forme *B. mollissima*. Used in this sense, *T. spiculosa* Fr. is regarded by several authors (Bourdot & Galzin, Hym. de Fr. 1928, 467; Bourdot & Maire, loc. cit.; Rea, Brit. Basid., 1922, 654; Lundell & Nannfeldt, Fung. Exsicc. Suecici No. 77, 1934) as synonymous with *Thelephora mollissima* Pers. ex Fr., and this is the name which I think should be adopted for *T. penicillata* Lloyd. Further work is necessary before this can be confirmed.

Dr. John Eriksson of Värnamo, Sweden, has kindly examined these specimens and has concluded that they are *Thelephora mollissima* Pers. ex Fr.

11. *Thelephora (Stereum) pulverulenta* Lév. (!) in Ann. Sci. Nat. ser. iii, 5 (1846) 149; Doidge in Bothalia 5 (1950) 491; Talbot in Bothalia 6 (1954) 323.

*Corticium (Coniophora) pulverulentum* (Lév.) Cooke in Grevillea 8 (1880) 89.

*Coniophora pulverulenta* (Lév.) Massee in Journ. Linn. Soc. Bot. 25 (1889) 129; Saccardo, Syll. Fung. 6 (1888) 649; Doidge in Bothalia 5 (1950) 480.

The type of this species, Drège 9442, as noted previously (Talbot, loc. cit.) is a *Hymenochaete*, probably *H. luteobadia* (Fr.) Höhnelt & Litsch.

12. *Thelephora punicea* Alb. & Schw.; Recorded for South Africa by Wood in Rept. Natal Bot. Gard. & Colonial Herbarium for 1898, p. 19; Kalchbrenner in Grevillea 10 (1881) 58.

J. M. Wood recorded this fungus as "*Thelephora punicea* Alb. & Schw., on bark, No. 190". Van der Byl (in Ann. Univ. Stellenbosch 7, 1929, 19) quotes Wood's record and gives a description, taken from Rea's "British Basidiomycetes", under *Hypochnus puniceus* (A. & S.) Sacc. Bourdot & Galzin (Hym. de Fr., 1928, 769) describe this species from Europe under the genus *Tomentella* as *T. punicea* (A. & S.) Schroet. Wood's collection is no longer in existence and so the record cannot be confirmed.

13. *Thelephora sinuans* Pers.; Recorded by Léveillé in Ann. Sci. Nat. ser. iii, 5 (1846) 146.

The record refers to a collection by Drège (944), Caput Bonae Spei, but no material is available from Herb. Mus. Paris and so the record has not been confirmed. Fide Lentz (U.S.D.A. Agric. Monogr. No. 24, 1955, 35) *T. sinuans* is a synonym of *Stereum frustulatum* (Pers. ex Fr.) Fuckel.

14. *Thelephora terrestris* Ehrh. ex Fr., Syst. Myc. 1 (1821) 431; Ehrhart, Crypt. Exsicc. No. 178 (1785); Doidge in Bothalia 5 (1950) 495.

*Thelephora laciniata* Pers. ex Fr., Syst. Myc. 1 (1821) 431; Persoon, Syn. Fung. (1801) 567.

#### FIG 9.

Fructifications effuso-reflexed and encrusting, more usually dimidiate and sessile, imbricate or confluent, occasionally shortly stipitate. Surface fawn to chocolate or

dark fuscous colour, usually strigose. Hymenium smooth to finely radiately rugose and papillate, concolorous. Texture coriaceous, soft, thin. Margin whitish then concolorous, entire to shortly laciniate and strigose-fibrous.

Basidia: not seen (fide Bourdot and Galzin:  $40-90 \times 9-12 \mu$ ).

Spores: coloured, fuscous, finely and sparsely verrucose, subglobose to broad ellipsoid and irregularly angled,  $(7)-9-11 \times 7-8 \mu$ .

Hyphae: coloured brownish, thin-walled, some inflating and then collapsing, with occasional clamps, not encrusted,  $3-5.5-8-(11) \mu$  diam.

Specimens examined: As *T. terrestris*: Nos. 27560, 30616, 40206, 40670, 40657, 13020, 19852, 27329, 27330, 1067, 10049.

As *T. intybacea*: No. 25863; Universiteit van Stellenbosch, Herbarium P. A. van der Byl Nos. 1263, 214, 1261, 922.

As *T. laciniata*: Nos. 11107, 34406, 30712; Herb. S.A. Mus. No. 34298 (*MacOwan* 1445), Table Mountain.

#### EXPLANATION OF THE ILLUSTRATIONS.

The following lettering has been used throughout the illustrations:—

B = Basidia.	G = Gloeocystidia.
C = Cystidia.	H = Hyphae.
CO = Conidia	HA = Habit.
CP = Conidiophores.	S = Basidiospores.
CY = Cystidioles.	SE = Setae.
D = Dendrophyses.	SH = Surface hairs.

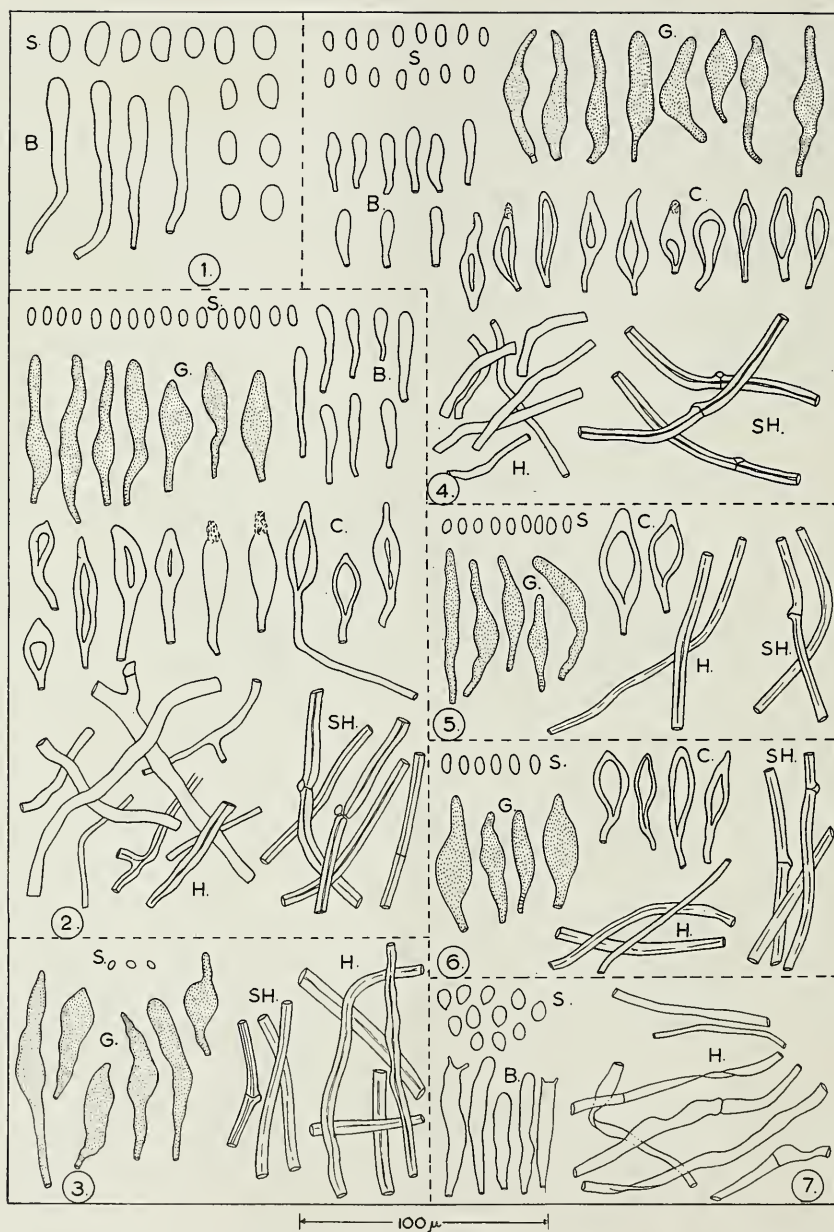


FIG. 1.—*Craterellus cornucopioides* (J. M. Wood No. 4108). FIG. 2.—*Cladoderris spongiosa*. FIG. 3.—*Cladoderris dendritica*. FIG. 4.—*Cladoderris australica* (J. M. Wood No. 239), neotype. FIG. 5.—*Cladoderris elegans*. FIG. 6.—*Cladoderris infundibuliformis*. FIG. 7.—*Cladoderris funalis* (Eyles No. 5026).



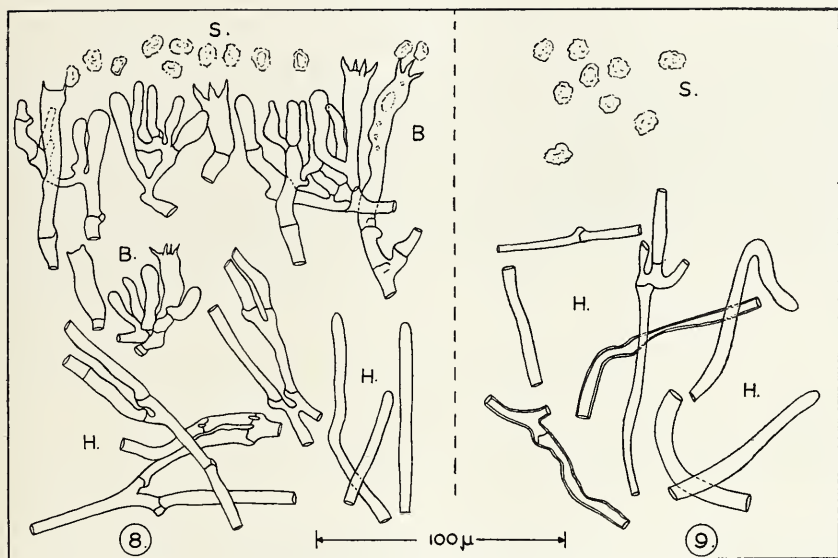


FIG. 8.—*Thelephora penicillata* Lloyd. FIG. 9.—*Thelephora terrestris*.



# Studies of some South African Resupinate Hymenomycetes.

## Part II.\*

By

P. H. B. Talbot.

The following descriptions and notes are based on material seen since the first paper in this series was published. I am indebted to the Transvaal and Orange Free State Chamber of Mines Timber Research Laboratory for submitting several interesting collections and particularly for allowing Miss V. C. Green to collaborate in the preparation of descriptions and illustrations of three of the species discussed here. My sincere thanks are also due to the Directors of the following institutions for the loan of specimens: Herbarium, Royal Botanic Gardens, Kew; Herbarium, British Museum (Natural History); Museum National D'Histoire Naturelle, Paris; U.S. National Fungus Collections, Beltsville; Herbarium, S.A. Museum, Cape Town; Herbarium, Dept. of Agriculture, Southern Rhodesia; Herbarium Len Verwoerd, Stellenbosch-Elsenburg Agricultural College.†

### PLATYGLOEA Schroet.

#### 1. *Platygloea opalina* sp. nov.

FIG. 1.

Resupinate, effused, gelatinous, forming a thin opalescent pellicle, drying to an extremely thin, shiny, light grey, subpruinose film, occasionally cracked across. Thickness in section 130–146  $\mu$ .

Basidia: probasidia arising as lateral branches of hyphae, clavate-cylindrical almost from the beginning, elongating and changing into a cylindrical metabasidium divided by transverse septa into 3–4 metabasidial cells each with a sterigma. Metabasidia 6.4–9  $\times$  60–80  $\mu$ .

Spores: hyaline, smooth, elliptical with one side flattened, or cylindric-depressed, with a lateral apiculus and often with one or more conspicuous guttules, (7.2)–8–9.6  $\times$  (14.4)–16–18.4  $\mu$ , germinating to form secondary spores on a lateral germ tube.

Hyphae: 2.4–5.6  $\mu$  wide, branched, with numerous septa, lacking clamp connections, thin-walled, erect, possessing large guttules in the wider hyphae, loosely intertexted.

Specimens examined: Type, 36951, Talbot, on *Acacia mollissima*, Atholl Expt. Stn., 1949.

This species does not correspond with any previously described species that I have been able to trace, including those in Bandoni's survey of the genus (in *Mycologia* 48, 1956, 821–840).

\* Part I of these studies appeared in *Bothalia* 6 (1951) 1–116.

† Vir die geleentheid om eksemplare in die Herbarium P. A. van der Byl te bestudeer en vergelyk is ek dank verskuldig aan die Universiteit van Stellenbosch.

*Platyglœa opalina* sp. nov.

Fungus resupinatus, effusus, gelatinosus, opalinus, tenuissimus, nitidus, pallidogriseus, 130–146  $\mu$  crassus, ut siccus subpruinosis vel membranaceus. Probasidia ab initio cylindræo-clavata; metabasidia cylindræa, transverso-septata, cellulis 3–4, 6.4–9  $\times$  60–80  $\mu$ . Sporae hyalinae, leves, ellipticae, uno latere compressae, laterale apiculatae, (7.2)–8–9.6  $\times$  (14.4)–16–18.4  $\mu$ . Hyphae 2.4–5.6  $\mu$  diam., ramosae, septatae, non nodoso-septatae, tenue tunicatae, erectae, laxae intertextae. Typus No. 36951, leg. P. H. B. Talbot, in ramis *Acaciae mollissimae*.

**EICHLERIELLA** Bresadola.

1. *Eichleriella macrospora* (Ell. & Everh.) Martin in Univ. Iowa Stud. Nat. Hist. 18 (1944) 48, Ibid. 29 (1952) 65, Figs. 14, 36.

*Corticium macrosporum* Ell. & Everh. in Bull. Torrey Bot. Club. 27 (1900) 49.

*Sebacina macrospora* (Ell. & Everh.) Burt in Ann. Mo. Bot. Gard. 2 (1915) 759.

FIG. 2.

Resupinate, composed at first of small, very thin, suborbicular, pruinose to byssoid growths of a light brown colour with white, cottony margin, becoming confluent to form a coriaceous-membranous patch, 6  $\times$  1 cm, with a narrow, determinate, white margin, adherent in the present specimen. Hymenium light brown, to greyish-white or pale dirty grey-brown, pruinose under the lens, beset with small, blunt tubercles which are fertile. Thickness in section 130–230  $\mu$ . Adnate, becoming cracked with deep fissures down to the substratum, revealing a white, cottony trama.

Basidia: tremeloid, the metabasidia clavate to elongated obovate, cruciately longitudinally divided, 9–11.5  $\times$  21–23  $\mu$ , sometimes showing a basal clamp connection. Sterigmata four, 3.5–4.5  $\times$  11.5–21  $\mu$ .

Spores: hyaline, smooth, oblong or broad-cylindric, sometimes very slightly depressed on one side, with a lateral apiculus, 0–1–2 guttulate, 5.7–(10)  $\times$  11.4–14.8  $\mu$ .

Paraphyses: (1) surrounding the basidia and projecting beyond them, 2.3–4.5  $\times$  22–45  $\mu$ , flexuous, tortuous, hyaline; (2) more clavate and not tortuous, arising from a clamp at the base of a basidium branch.

Hyphae and Tissue Differentiation: Some hyphae appearing to be next to the substratum are colourless, much branched, 2.8–3.4  $\mu$  wide, (thin) to thick-walled; also present are plentiful brownish concretions which take phloxine stain readily and are apparently mixed with gelatinised hyphae in an intermediate layer.

Specimens examined: 39090, Talbot, On *Acacia* sp., Buffelspoort.

Except for the margin, which in this specimen is not free or reflexed, there is good agreement with Martin's description of *E. macrospora*. From McGuire's monograph of *Sebacina* (in Lloydia 4, 1941, 23) it appears that *Sebacina calcea* (Pers.) Bres. is close in characters to the present specimen, but may be distinguished by its longer spores, absence of tubercles, and paraphyses loaded with granules.

**HETEROCHAETE** Patouillard.

1. *Heterochaete byliana* sp. nov.

FIG. 5.

Resupinate, orbicular then widely effused, closely adnate, crustose-farinaceous. Hymenium whitish to pale straw-coloured or slightly greyed, somewhat pruinose, bearing scattered, sterile white (occasionally pale tinted) hyphal pegs which are not perfectly cylindrical and are sometimes forked, arising near the surface of the hymenium



and projecting 90–160  $\mu$ , measuring 32–48  $\mu$  wide, composed of practically hyaline hyphae 1.8–3.2  $\mu$  in diameter, somewhat dendroid, without appreciably thickened walls. Margin indeterminate, pruinose, concolorous, without a conspicuous bordering zone free from pegs. Thickness in section about 65  $\mu$ , excluding the pegs.

Basidia: probasidia pyriform to ovate, 12.8–19  $\times$  7.7–11  $\mu$ ; metabasidia cruciately longitudinally divided; sterigmata two, of variable length (up to 18  $\mu$  seen) and 3.2–3.7  $\mu$  wide.

Basidiospores: broad elliptic-depressed to suballantoid, hyaline, smooth, occasionally apiculate, 11.4–17.4  $\times$  5–8.3  $\mu$ .

Hyphae: hyaline, subgelatinous, difficult to distinguish except at the base where they are light brown with thin, rigid walls, 1.8–2.3  $\mu$  diam.; all hyphae lacking clamps.

Tissue differentiation: white, subgelatinous throughout except for the darker basal seam of more or less horizontal hyphae sometimes distinguishable.

Conidial stage: seen in part of a specimen, consisting of white, pruinose tufts with globose, hyaline conidia 2.3–3.6  $\mu$  diam.; conidial hyphae hyaline, thin-walled, 1.4–3.2  $\mu$  diam.

Chlamydospores terminal or intercalary, sometimes in short chains.

Specimens examined: Type, 41049, *Talbot*, Umtentweni, Natal, 1955; As *Heterochaete andina* Pat. & Lagerh.: Universiteit van Stellenbosch, Herbarium P. A. van der Byl No. 629, No. 698, on *Euphorbia pulcherrima*, No. 785, on *Plectronia*, all from Durban.

Van der Byl (in Ann. Univ. Stellenbosch, 1, 1923, 5), classed his specimens as *H. andina*, but thanks to Bodman's account of this species (in Mycologia 41, 1949, 529, f. 2) it is possible to differentiate it. *H. andina* has a pinkish tint to the fructification and possesses gloecystidia and cystidia, but otherwise appears to be close to the new species *H. byliana*. The latter differs from *Heterochaete grandispora*, which was collected in the same locality, in its appreciably smaller spores and lack of gloecystidia, and in being totally resupinate.

### *Heterochaete byliana* sp. nov.

Fungus resupinatus, orbiculatus deinde late effusus, adnatus, crustaceo-farinaceus. Hymenium albidum vel pallido-stramineum vel griseum, pruinose, fasciculos hypharum ferens albidus, pallidus, 32–48  $\mu$  diam., 90–160  $\mu$  emergentes, ex hyphis hyalinis, dendroideis, 1.8–3.2  $\mu$  diam. formatos. Margo indeterminata, concolor. Probasidia pyriformia vel ovata, 12.8–19  $\times$  7.7–11  $\mu$ . Metabasidia sterigmatibus 2 usque ad 18  $\mu$  longa et 3.2–3.7  $\mu$  diam. Basidiosporae ellipticae vel suballantoideae, hyalinae, leves, 11.4–17.4  $\times$  5–8.3  $\mu$ . Hyphae hyalinae, subgelatinosae; hyphae basales pallido-brunneae, 1.8–2.3  $\mu$  diam., tenue tunicatae, non nodoso-septatae. Conidia hyalina, globosa, 2.3–3.6  $\mu$  diam. Chlamydosporae adsunt. Typus No. 41049, leg. P. H. B. Talbot.

## 2. *Heterochaete grandispora* sp. nov.

### FIG. 4.

Resupinate or with reflexed margin, at first orbicular then confluent up to 1.5 cm diam., coriaceous. Hymenium white to pale straw colour, beset with abundant light brown, sterile, hyphal pegs originating in the trama and projecting 187–295  $\mu$ , 40–65  $\mu$  wide, composed of yellow-brown, parallel, interwoven hyphae 3.2  $\mu$  wide, with thickened walls. Margin concolorous, not adnate, determinate, often very slightly reflexed, free of hyphal pegs up to 1 mm from the edge. Context pale brown below a colourless hymenial layer. Thickness in section 280–380  $\mu$ .

Basidia: probasidia ovate-pyriform, becoming longitudinally cruciately divided.  $18-20 \times 10-11.8 \mu$ , embedded below the surface; metabasidia of the same dimensions; sterigmata of variable length,  $2.7 \mu$  wide.

Spores: cylindric-curved to allantoid, smooth, hyaline,  $(15)-23-30 \times (5.9)-7.3-9 \mu$ , with a prominent truncate apiculus, germinating by repetition.

Gloeocystidia: in the hymenium, hyaline with a homogeneous content, not readily seen,  $34-63 \times 4.5-8.2 \mu$ .

Paraphyses: the hymenial hyphae rarely run out into rather simple hyaline dendrophyses, forked shortly once or twice,  $1.4-2.7 \mu$  diam.

Hyphae: lightly coloured, densely intertexted, rarely branching or septate, thick-walled,  $1.5-3.2 \mu$  diam., with undulating walls, lacking clamps. Hymenial hyphae similar but colourless.

Tissue differentiation: There is a colourless, subgelatinous hymenial layer above a light brown context.

Specimens examined: Type, 41050, *Talbot*, Umtentweni, Natal, 1955.

Martin [in Univ. Iowa Stud. Nat. Hist. 19 (1952) 62] estimates that about thirty species of *Heterochaete* have been described. Descriptions of most of these have been traced without finding any species approaching *H. grandispora* in spore size. Its margin, which is free of hyphal pegs and tends to be reflexed, and the widely spaced hyphal pegs, are characteristic.

*Heterochaete grandispora* sp. nov.

Fungus resupinatus vel margine reflexa, orbiculatus deinde confluent, coriaceus. Hymenium albidum vel pallido-stramineum, fasciculos hypharum ferens pallido-brunneos,  $40-65 \mu$  diam.,  $187-295 \mu$  emergentes, ex hyphis parallelis, luteo-brunneis,  $3.2 \mu$  diam., formatos. Margo concolor, determinata, sine fasciculis hypharum. Probasidia ovato-pyriformia; metabasidia  $18-20 \times 10-11.8 \mu$ , sterigmatibus  $2.7 \mu$  diam. Sporae cylindraceo-curvedae, leves, hyalinae, apiculo truncato,  $(15)-23-30 \times (5.9)-7.3-9 \mu$ . Gloeocystidia hyalina,  $34-63 \times 4.5-8.2 \mu$ . Paraphyses  $1.4-2.7 \mu$  diam., hyalini, simplices, dendrophytici. Hyphae pallidae, dense intertextae, crasse tunicatae,  $1.5-3.2 \mu$  diam., undulatae, non nodoso-septatae. Typus No. 41050, leg. P. H. B. Talbot.

### PELLICULARIA Cooke sensu Rogers.

M. A. Donk (in Reinwardtia 2, 1954, pp. 425-434; *ibid.* 3, 1956, p. 369) argues with great justification that *Pellicularia koleroga* Cooke, the type species of the genus *Pellicularia*, is a *nomen confusum*, and that accordingly the generic name to be used for this group of species is *Botryobasidium* Donk. In the latter paper Donk also proposed two generic segregates, *Uthatobasidium* and *Thanatephorus*. Several "*Pellicularia*" species have already been combined under *Botryobasidium*, but there are still some for which a new combination would be necessary if the genus *Pellicularia* is to be dropped. It is to be regretted that Donk did not formally propose such combinations in his recent papers cited above. Without studying a much greater range of material than was available to me, I do not wish to propose the new combinations that might be necessary, and for the sake of uniformity have treated all these species under *Pellicularia*.

One new combination that Donk did make (in Reinwardtia 3, 1956, 376) may be noted: This is *Thanatephorus cucumeris* (Frank) Donk [= *Hypochnus cucumeris* Frank; *Hypochnus solani* Prill. & Delacr.; *Pellicularia filamentosa* (Pat.) Rogers].

1. *Pellicularia vaga* (B. & C.) Rogers ex Linder in Lloydia 5 (1942) 170; Rogers in Farlowia 1 (1943) 110, f. 9.

*Corticium vagum* Berk. & Curt. in Grevillea 1 (1873) 179. Further references and synonymy are given by Rogers (1943, l.c.).

FIG. 6.

Resupinate, thin, discontinuous, arachnoid later becoming hypochnoid, dirty whitish to pale tawny-yellowish.

Basidia: collapsing rather readily,  $6.4 \times 17.6 \mu$ , cylindrical or somewhat inflated at the base or apex [fide Rogers " $13-22-(27) \times 6.5-10-(15) \mu$ , bearing rarely 4 or 5, mostly 6-8 stout, divergent recurved sterigmata  $(3)-4.5-6 \times 1.5-2 \mu$ "].

Spores: hyaline, smooth, navicular or asymmetrically fusiform, obliquely tapered,  $4.5-6 \times 9.6-12.8 \mu$  [fide Rogers " $7.5-12-(17) \times (2.5)-3.5-5-(5.5) \mu$ "]

Hyphae: loosely intertexted, smooth, lacking clamps, branching at right angles, with thin, rigid walls and a wide lumen, the basal hyphae slightly yellowish and up to  $13 \mu$  wide with long internodes, the superior hyphae narrower, colourless, short-celled.

Specimens examined: 41048, Talbot, on dead wood in contact with the soil, Umtentweni, Natal, 1955.

*Corticium vagum* B. & C. has been recorded previously for South Africa by Doidge (in Bothalia 5, 1950, 483) who cites *Corticium solani* (Prill. & Delacr.) Bourd & Galz. as a synonym. These records require confirmation by reference to the cited specimens since the name *C. vagum* has been used in conflicting senses. Rogers (1943, loc. cit.) identifies the type material of *C. vagum* with *Pellicularia vaga* (B. & C.) Rogers ex Linder, and points out that *C. vagum* sensu Burt (in Ann. Mo. Bot. Gard. 13, 1926, 295) is synonymous with *Pellicularia filamentosa* (Pat.) Rogers, and that *Corticium solani* is another synonym of this parasitic species.

The collection described above was saprophytic and corresponds well with *Pellicularia vaga*, whose distinguishing features, according to Rogers are its saprophytic habit, its smooth navicular spores, its lack of clamp connections and cystidia, and its wide hyphae. *Pellicularia filamentosa*, on the other hand, is parasitic, and its spores are ellipsoid or oblong-ellipsoid, flattened on the inside, with an abruptly truncate apiculus.

## 2. *Pellicularia fodinarum* Talbot & Green, sp. nov.

FIG. 7.

Resupinate, thin, easily separable, pruinose-pellicular, with a similar margin. Hymenium yellowish, discontinuous, beset with long, emergent, hairlike septocystidia.

Basidia: in botryose clusters, very easily collapsing, cylindric-clavate,  $4-6 \times 15-22 \mu$ ; adventitious groups of basidia arise as lateral offshoots of some of the septocystidia.

Spores: hyaline, smooth, subglobose to broad ovate-elliptical,  $5-7.5 \times 4.5-6 \mu$ .

Cystidia: very long, cylindrical, hyaline, septate, lacking clamps at the septa, with rounded apex, encrusted their full length with small wartlike granules (probably derived from a mucilaginous investment), up to  $360 \mu$  long and  $6-9 \mu$  wide.

Hyphae: loosely intertexted, collapsed in the hymenium otherwise distinct, much branched, anastomosed, septate, lacking clamps, thin-walled, encrusted with small wartlike granules,  $4-6 \mu$  wide.

Minerals: abundant throughout the tissues.

Specimens examined: Type, 40679 (T.R.L. 2635), A. L. James, on underground timber. Brakpan No. 1 Shaft, Dec., 1950.



In its yellow colour, possession of septocystidia and spore characters this species is closely allied to *Pellicularia zealandica* G. H. Cunn. (in Trans. Roy. Soc. N.Z. 81, 1953, 322, Figs. 1, 2). *P. zealandica* does not, however, produce adventitious basidia from the septocystidia, possesses clamps in the hyphae and septocystidia, lacks encrusted hyphae and has the encrustation of the septocystidia confined to near the apex. Some rather similar fungi are placed by Bourdot & Galzin (Hym. de Fr., 1928) in the section Hyphales of the genus *Peniophora* but none of these corresponds exactly with this new species.

*Pellicularia fodinarum* Talbot & Green, sp. nov.

Fungus resupinatus, tenuis, non adnatus, pruinoso-pelliculatus. Hymenium luteolum, septocystidiis longis, emergentibus, ad pilos accedentibus. Basidia cylindraceo-clavata,  $4-6 \times 15-22 \mu$ ; basidia adventitia lateralia ex quibusdam septocystidiis oriuntur. Sporae hyalinae, leves, subglobosae vel ovato-ellipticae,  $5-7.5 \times 4.5-6 \mu$ . Cystidia cylindracea, hyalina, septata, non nodoso-septata, apicibus rotundis, undique granis verrucosis incrustata, usque ad  $360 \mu$  longa,  $6-9 \mu$  diam. Hyphae laxae intertextae, ramosae, anastomosae, septatae, non nodoso-septatae,  $6 \mu$  diam., granis verrucosis incrustatae. Typus No. 40679 (TRL 2635), leg. A. L. James, in ligno in aurifodinae.

3. *Pellicularia filamentosa* (Pat.) Rogers in Farlowia 1 (1943) 113, Fig. 11.

*Hypochnus filamentosus* Pat. in Bull. Soc. Myc. de Fr. 7 (1891) 163, Pl. 11, Fig. 2.

*Corticium solani* (Prill. & Delacr.) Bourd. & Galz. in Bull. Soc. Myc. de Fr. 27 (1911) 248.

*Corticium vagum* sensu Burt in Ann. Mo. Bot. Gard. 5 (1918) 128, Fig. 3, a, Ibid. 13 (1926) 295, Fig. 3, *pro parte* (nec. *C. vagum* Berk. & Curt.).

*Corticium vagum* var *solani* Burt ex Rolf in Science n.s. 18 (1903) 729. For further synonymy see Rogers, loc. cit.

#### FIG. 8.

Fructifications resupinate, hypochnoid to pellicular, delicate, thin, drying white or buff-coloured.

Basidia: in botryose clusters, often discontinuous, subcylindrical to clavate or widest in the middle,  $13-22 \times 9-11 \mu$ , with four long sterigmata.

Spores: hyaline, smooth, ellipsoid, flattened on one side, with a truncate apiculus,  $8-12 \times 5-7 \mu$ .

Hyphae: hyaline, thin-walled, except at the base where they have slightly thickened walls and are pale coloured, lacking clamps, not encrusted, much branched at right angles, septate,  $5-12 \mu$  wide (up to  $17 \mu$  wide fide Rogers).

Specimens examined: Myc. Herb. Dept. Agric. S. Rhodesia, No. 5151, J. C. Hopkins, on *Solanum tuberosum*, Inyanga (as *Corticium solani*); 41434, Martin, on *Amarantus paniculatus*, Kempton Park.

Doidge (in Bothalia 5, 1950, 483) cites this specimen of Hopkins under *Corticium vagum* Berk. & Curt., but it is in excellent condition and a very good match with *P. filamentosa*. The former confusion existing between *Pellicularia vaga* (B. & C.) Rogers ex Linder and *P. filamentosa* (Pat.) Rogers is noted under the first of these species.

Two other specimens cited by Doidge viz. Myc. Herb. Dept. Agric. S. Rhodesia Nos. 4863 and 1783 as *Corticium vagum* were examined, but these have apparently deteriorated and no *Pellicularia* was found upon them. Another specimen, Pons, 29964, is sterile and indeterminate, though its wide hyphae and their arrangement suggest a species of *Pellicularia*.



#### 4. *Pellicularia asperula* Rogers in Farlowia 1 (1943) 100, f. 2.

##### FIG. 37.

Fructification resupinate, delicate, pruinose to subpellicular, discontinuous, with conspicuous basal hyphae showing under the lens, drying near Pale Olive Buff or Smoke Gray (Ridgway).

Basidia:  $9.5-17.2 \times 7-8 \mu$ , subcylindric, with a more or less truncate, slightly expanded apex, with 6-(8) curved sterigmata up to  $4.5 \mu$  long.

Spores:  $4.5-5.2-5.6-(6) \times 3.0-4.0-(4.5) \mu$ , ellipsoid, a little flattened on one side, apiculate, minutely asperulate, abundant, often coherent, hyaline to faintly coloured.

Hyphae:  $4-15.5 \mu$  wide, without clamps, branched at right angles, the basal hyphae widest, long celled and with lightly coloured thickened walls up to  $1.7 \mu$  thick; the superior hyphae hyaline, narrower, shorter celled, thin-walled and with cruciform cells.

Specimens examined: 41545, *P. H. B. Talbot*, on fallen twigs and litter of *Acacia mollissima*, Byrne, Natal, Apr., 1956. (Part also in New York Bot. Garden Herbarium).

This species was abundant when collected, forming a thin greyish covering to fallen twigs and humus, but only seen when the top layer of humus was disturbed. Microscopically the spores are very distinctive and differ from those of all other known species of *Pellicularia*. I am greatly indebted to Dr. D. P. Rogers for confirming my identification of this material and comparing it with the type collection. The species was previously known only from the type collection from Cuba.

#### CONIODICTYUM Har. & Pat. emend. G. Malençon.

1. *Coniodictyum chevalieri* Har. & Pat. in Bull. Soc. Myc. de Fr. 25 (1909) 13-14, Figs. a-c; Malençon in Bull. Soc. Myc. de Fr. 69 (1953) 77-100, Figs. 1-8 (as *Coniodictyum*).

*Hyalodema evansii* P. Magnus in Ber. Deutsch Bot. Gesellsch. 28 (1910) 377-380, Pl. 11.

*Coniodictyum evansii* (P. Magn.) P. Magn. in Ber. Deutsch Bot. Gesellsch. 29 (1911) 1-2; Doidge in Bothalia 5 (1950) 685.

##### FIG. 3.

Mycelium parasitic in tissues of *Zizyphus*, filamentous, intercellular, hyphae  $2-4 \mu$  diam., branched, septate, hyaline, with short coralloid, poorly differentiated haustoria, forming galls on the fruits, leaves, petioles and twigs. Hymenium subcortical, covered then erumpent, pulverulent, whitish-yellow, composed of homobasidia bearing basidiospores.

Basidia: clavate,  $7-8 \times 23-36 \mu$ , often deformed or atrophied, sometimes thick-walled especially near the apex, asterigmate.

Basidiospores: borne in a corona of (2)-4-8 sessile, ovoid, smooth spores at the apex of the basidium, hyaline, often deformed, coherent, becoming falsely septate through the development of a number of hyaline, spherical to compressed polygonal internal chlamydospores, the basidiospores finally coalescing into an irregular, hyaline, multicellular, dictyosporous ball,  $15-20 \times 18-28 \mu$ , which is detached as a whole from the basidium.

Specimens examined: All on *Zizyphus mucronata*: 92, *J. Burt Davy*, Zoutpansberg (presumed part of type of *H. evansii*); 1006, *Pole Evans*, Fountains; 30667, *L. Krause*, Johannesburg; 30223, *W. G. Rump*, Pietermaritzburg; 20611, *E. M. Doidge*, Hartbeespoort; 15019, *J. M. Sim*, Pietermaritzburg; 11812, *T. Pallister*, Marikana;

11240, *J. M. Sim*, Buccleuch, Natal; 10095, *A. Jansen*, Dundee; 41019, *S. Truter*, Pietermaritzburg; 1214, *P. J. Pienaar*, Garstfontein; 2537, *H. L. Hall*, Nelspruit; 5648, *Pole Evans*, Cramond; 8789, *A. Pegler*, Kentani.

The genus *Coniodictyum* was at first classed as a member of the Hyphomycetaceae (Mucedineae-Hyalodictyaceae), and only recently has Malençon (loc. cit.) shown in an excellent paper on the nature and affinities of *C. chevalieri* that this and three other puzzling genera are actually homobasidiomycetes and may best be accommodated in a new family, the Cryptobasidiaceae G. Malençon, coming near to the Exobasidiaceae. So far as is known *C. chevalieri* is purely African in distribution, and in South Africa it is recorded from parts of the Transvaal, Natal and Cape Provinces.

### CONIOPHORA DC. ex Pers.

1. *Coniophora arida* (Fr.) Karsten, Finska Vet.-Soc. Bidrag Natur och Folk 37 (1882) 161; Saccardo Syll. Fung. 6 (1888) 648; Burt in Ann. Mo. Bot. Gard. 4 (1917) 244, f. 3; Bourdot & Galzin, Hym. de Fr. (1928) 359.

*Thelephora (Coniophora) arida* Fries, Elenchus Fung. 1 (1828) 197.

*Corticium (Coniophora) aridum* Fries, Hym. Eur. (1874) 659.

#### FIG. 9.

Resupinate, effused, adherent, floccose then pellicular or arid, or thinly submembranous, not readily separable. Hymenium smooth, not tubercular, pulverulent, bright sulphur yellow dulling to ochraceous or chamois then fawn olive to brown. Margin indeterminate, widely fibrillose to byssoid, eventually much reduced, whitish, composed of cordons of hyphae.

Basidia: subcylindrical to clavate,  $25-50 \times 6-8 \mu$ , with four sterigmata.

Spores: smooth, pale yellow to brown, ovate to ellipsoid,  $10-13 \times 6-7 \mu$ .

Hyphae: thin-walled, non-encrusted, septate, hyaline or pale coloured,  $3-6 \mu$  wide, the basal and marginal hyphae often up to  $12 \mu$  wide; ordinary clamp connections rare, whorled clamps present on some of the wide marginal hyphae, with branch hyphae often arising in whorls from these clamps.

Specimens examined: 41051, *Forest Res. Officer*, on *Pinus taeda*, Border Plantation, Natal; 39075 and 39076, *Talbot*, on *Acacia mollissima*, Atholl. Expt. Stn., E. Tvl.

*Coniophora arida* differs from *C. puteana* in the brighter colour of its fructification, which is also thinner, drier, less fleshy-membranous, and whose hymenium is not tuberculate and not easily separable from the substratum. The hyphae of *C. arida* tend to become pale coloured and are less compactly arranged than those of *C. puteana*. The characteristic whorled clamps which often give rise to whorls of branches on the wide marginal hyphae are not mentioned in descriptions available to me, but I have found them also on reliably determined exsiccati from England and Europe.

2. *Coniophora atrocinerea* (Karst.) Karst.; Recorded by van der Byl in Ann. Univ. Stellenbosch 7 (1929) 17; Doidge in Bothalia 5 (1950) 480.

The record of this species is based on two specimens on *Pinus* in Universiteit van Stellenbosch, Herbarium P. A. van der Byl Nos. 2451 and 2433. Both specimens have been examined and are referable to *Coniophora olivacea* [(Fries) ex Pers.] Karst., a species dealt with previously [in Bothalia 6 (1951) 35]. Rogers & Jackson (in Farlowia 1, 1943, 273) state that *C. atrocinerea* is synonymous with *C. olivacea*, and they give a very full synonymy and useful taxonomic notes on the species.

3. *Coniophora betulae* (Schum.) Karst.; Recorded by Doidge in Bothalia 5 (1950) 480.

The specimen of this record is No. 30633, *K. Morgan*, which is here made the type of *Coniophora incrustata* Talbot, sp. nov.

4. *Coniophora cerebella* Pers.; South African records cited by Doidge in *Bothalia* 5 (1950) 481.

Doidge (loc. cit.) indicates this species as a synonym of *Coniophora puteana* (Schum. ex Fr.) Karst., which it is generally accepted to be. However, none of the South African specimens cited are the latter species. (see under *C. puteana*).

5. *Coniophora incrustata* sp. nov.

FIG. 10.

Resupinate, membranous, not adnate, readily detached from the substratum in large sheets. Margin not notably differentiated. Hymenium light brown to "Warm sepia" or "Bister" (Ridgway) from the accumulated spores. Thickness in section about 650  $\mu$ .

Basidia: not seen.

Spores: deep red-brown in a mass, yellow-brown in the microscope, smooth, ovate-elliptical, (5·6)–6–6·5–(8)  $\times$  (8·8)–9·6–11  $\mu$ , very copiously produced, some embedded in the tissues.

Hyphae: hyaline to pale straw-colour, the upper ones more or less indistinct, the basal ones distinct, very thin-walled and soon collapsing, 3–6–(8)  $\mu$  wide when not collapsed, coated very heavily with mineral granules.

Specimens examined: Type, 30633, *K. Morgan*, on walls in dairy, Hopevale, Donnybrook, 1939.

This species has heavily encrusted, readily collapsing hyphae like those of *Coniophora betulae* (Schum.) Karst. or *C. suffocata* (Peck) Masee, but differs from these in several respects. It is appreciably thicker, more membranous, separable in large pieces, lacks a notably whitish margin, and above all has much darker spores which colour the hymenium a warm sepia or bister colour in contrast to the yellowish-olive-brown (tawny olive or umber) of the other two species. It is felt that these differences are sufficient to warrant the proposal of a new species. It is not entirely certain whether or not *C. betulae* and *C. suffocata* are distinct from one another, and in *Coniophora* as a whole there are few differential characters and numerous intermediates occur. *C. fumosa* Karst. has somewhat the same colour as *C. incrustata*, but rather smaller spores and non-encrusted hyphae, which are darker and distincter.

*Coniophora incrustata* sp. nov.

Fungus resupinatus, membranaceus, facile separabilis. Hymenium pallido-brunneum vel sepiaceum. Sporae in cumulo atro-badiae, in microscopio luteo-brunneae, leves, ovato-ellipticae, (5·6)–6–6·5–(8)  $\times$  (8·8)–9·6–11  $\mu$ . Hyphae hyalinae vel pallido-stramineae; hyphae basales distinctae, tenue tunicatae, mox collabentes, 3–6–(8)  $\mu$  crassae, mineralibus forte incrustatae. Typus No. 30633, leg. *K. Morgan*, in muro.

6. *Coniophora pulverulenta* (Lév.) Masee in Journ. Linn. Soc. Bot. 25 (1889) 129; Saccardo Syll. Fung. 6 (1888) 649; Doidge in *Bothalia* 5 (1950) 480.

*Thelephora* (*Stereum*) *pulverulenta* Lév. (!) in Ann. Sci. Nat. ser. iii, 5 (1846) 149; Doidge in *Bothalia* 5 (1950) 491; Talbot in *Bothalia* 6 (1954) 323.

*Corticium* (*Coniophora*) *pulverulentum* (Lév.) Cooke in *Grevillea* 8 (1880) 89.

The type of this species, Drège 9442, has been examined and, as noted in *Bothalia* 6 (1954) 323, proved to be most probably *Hymenochaete luteobadia* (Fr.) Höhnelt & Litsch.

7. *Coniophora puteana* (Schum. ex Fr.) Karst.; Doidge in *Bothalia* 5 (1950) 481.

The records of this species in South Africa are summarised by Doidge (loc. cit.) All the specimens cited, except that collected by Laughton at Tokai, have been seen, and none of them is *C. puteana*. The three collected by Mrs. R. Brown in gold mines are all *Coniophora fodinarum* Talbot; No. 29723 on imported timber, is a species of *Coniophora* but not *C. puteana*; No. 30799 is a specimen of wood showing a cubical rot but the fungus is so scanty that it is indeterminable, and it bears basidiospores which are hyaline,  $3.5-8.8\ \mu$ , and are certainly not those of a *Coniophora*.

### PUNCTULARIA Patouillard.

1. ***Punctularia tuberculosa*** (Pat.) Pat. (!) apud Patouillard & Lagerheim in Bull. Herb. Boiss. 3 (1895) 57, Pl. 2, Figs. 1, a-g; Patouillard, Essai Taxon sur les Hym. (1900) 57, f. 60; Saccardo Syll. Fung. 14 (1899) 223.
- Corticium ? tuberculosum* Pat. apud Patouillard & Lagerheim in Bull. Soc. Myc. de Fr. 8 (1892) 118; Saccardo Syll. Fung. 11 (1895) 126.
- Punctularia atropurpurascens* (B. & Br.) Petch in Ann. Roy. Bot. Gard. Perad. 6 (1916) 160.
- Thelephora atropurpurascens* B. & Br. in Journ. Linn. Soc. Bot. 14 (1875) 64; Saccardo Syll. Fung. 6 (1888) 546.
- Punctularia affinis* (B. & C.) Talbot in *Bothalia* 6 (1951) 25, Pl. 17.
- Reticularia affinis* B. & C. (!) in Journ. Linn. Soc. Bot. 10 (1869) 347; Saccardo Syll. Fung. 7 (1888) 418.
- Reticularia venulosa* B. & C. (!) in Journ. Linn. Soc. Bot. 10 (1869) 347; Saccardo Syll. Fung. 7 (1888) 419 (as *R. venosa*).
- Reticularia atro-rufa* B. & C. (!) in Journ. Linn. Soc. Bot. 10 (1869) 347; Saccardo Syll. Fung. 7 (1888) 419.
- Ceratomyces venulosus* (B. & C.) Torrend in Bull. Soc. Portug. Sci. Nat. 4 (1910) 9.
- Trichosporium curtisii* Massee in Journ. Mycol. 5 (1889) 185, t. 14, f. 3; Saccardo Syll. Fung. 10 (1892) 583.
- Corticium conigenum* Shear & Davidson (!) in *Mycologia* 36 (1944) 296, f. 1-2.

### FIGS. 14-25.

*Conidial Stage*: loose, floccose, pulvinate or irregular tufts of hyphae, forming a growth several mm thick, powdery with innumerable conidia, later collapsing into a tangled mass of hyphae and conidia, coloured various shades of reddy-brown to purple-brown or vinaceous-brown (carob brown, burnt umber, cameo brown, vinaceous brown, seal brown, warm blackish brown—Ridgway) or sometimes partly violaceous to lavender blue or greyish blue (greyish violet-blue, dark plum-purple, bluish violet-black—Ridgway), the margin whitish when young.

Hyphae: often adhering in strands,  $2-3\ \mu$  wide, lightly coloured, thin-walled, branched, with clamp connections and septa, often minutely sculptured or encrusted with small mineral granules.

Conidia: purplish-brown in a mass, globose, oval or ellipsoid with much variation in shape,  $(3.6)-4.4-5.6\ \mu$  diam., or  $3.6-4.5 \times (5)-5.5-6.8-(8)\ \mu$ . In culture the conidiophores are much branched and modified above into an acropetal chain of



alternately swollen and clamped portions. The specialised terminal and intercalary swellings round off into atherosporous conidia which are set free by dissolution of the adjoining parts of the conidiophore, fragments of which may remain attached to one or both ends of the conidia. The liberated conidia are smooth or very minutely punctate at first, later becoming minutely verrucose, and finally strongly verrucose and shrunken in old cultures.

*Basidal Stage*: effused, resupinate, loosely adnate, rarely narrowly but distinctly reflexed, subgelatinous, drying waxy to horny and crustose. Margin inconspicuous or shortly byssoid, indefinite or definite. Hymenium developed on small, discoid to elongated pulvinae which are seated on a common foundation tissue and separated by sterile fissures containing amorphous mineral matter which occasionally forms a conspicuous pale buff-coloured fringe to the pulvinae. When moist the pulvinae are irregularly hemispherical, wider at the apex than the base, and coloured a medium to rich reddish-brown; when dry they are flattened, irregularly areolate, coloured deep purple-brown or blue-black to fuscous (deep slaty brown, aniline black, fuscous—Ridgway), with a minutely dark-punctate surface which is not conspicuously convoluted. Dark brown abhymenial hairs are present in both resupinate and reflexed parts of the fructification. Thickness in section averages  $400\text{--}500\ \mu$ , excluding the abhymenial hairs.

*Basidia*: long, flexuous, cylindric-clavate,  $27\text{--}51 \times 4\text{--}7\ \mu$ , with 4 sterigmata, often with basal clamps. The basidia are seldom mature when collected, but fresh specimens may be induced to spore after a few hours in a damp chamber.

*Basidiospores*: hyaline (? finally very dilutely coloured), smooth, ovoid to ellipsoid, often with one flattened side,  $(2\cdot7)\text{--}3\cdot5\text{--}4\cdot(5) \times 5\cdot5\text{--}7\cdot3\text{--}(8)\ \mu$ .

*Dendrophyses*: in hymenium, composed of a hyaline, thick-walled stem bearing a dark brown, irregularly swollen, shortly branched apex. Apical part up to  $5\cdot4\ \mu$  wide and  $29\ \mu$  long; stem  $2\cdot3\text{--}4\cdot1\ \mu$  diam.

*Context hyphae*: subgelatinous, hyaline, smooth, mostly rather indistinct, about  $2\ \mu$  wide, with clamp connections.

*Abhymenial hyphae*: dark brown, fibrillose, densely interwoven, branched, smooth, thick-walled, with clamps,  $(2)\text{--}2\cdot5\text{--}4\cdot5\ \mu$  wide, some penetrating the substratum.

*Tissue differentiation*: the abhymenial hairs arise from a dark basal seam. The middle layer is hyaline, subgelatinous, containing scattered mineral concretions and somewhat indistinct hyaline hyphae. The hymenium is subgelatinous, containing abundant lightly coloured mineral granules and dark dendrophyses giving it a general light brown colour.

*Specimens examined*: As *P. tuberculosis* ex Herb. Mus. Paris—Type, leg. de Lagerheim, Puente de Chimbo, Ecuador, Aug., 1871; *C. Torrend*, Mycotheca Lusitanica, on *Olea europea*, Lumiar, 1-08; *Rick*, Fungi Austro-Americani 54, Sao Leopoldo, Brazil; As *Corticium conigenum*—Type, Shear (1405), on *Quercus* sp., Weikiwa Spa, Florida, ex U.S. National Fungus Coll.; Also specimens listed in Bothalia 6 (1951) 26, and No. 40150, Talbot, Pretoria.

In a previous publication (Talbot, loc. cit.) I regrettably overlooked the Rule (Art. 69, Stockholm Code) that the first valid name or epithet applied to the perfect state must take precedence as the name for the fungus, and incorrectly combined the earliest epithet for the conidial state under *Punctularia*.

*Corticium conigenum* Shear & Davidson, was suspected to be a *Punctularia* from the authors' description and illustrations. Comparison of its type with that of *P. tuberculosis* has not revealed any specific differences. In interesting cultural studies

Shear & Davidson found that single basidiospore cultures produced no clamps and consisted of two sex strains, which when grown together would produce clamps along the line where the two opposite strains met in culture. Clamps were not produced by combinations of cultures within the same sex strains. Basidiospore cultures gave rise to the conidial stage.

The method by which the conidia are formed in *P. tuberculosa* is particularly interesting, and approximates to that shown by the mould fungi grouped in Section 1 B of Hughes' classification of the types of conidiophore and conidium development (Hughes in Canad. Journ. Bot. 31, 1953, 577-659), except that here it is modified by the clamp connections.

In his description and illustrations of *P. tuberculosa*, Patouillard exaggerated the discreteness of the hymenial pulvinae. In rather small areas of the type they are discrete and surrounded by the pale coloured amorphous mineral matter, but mostly they are so close together, and separated by such narrow fissures, that the mineral fringe is not really conspicuous, and the whole appears more or less areolate and flattened, especially when dry. The dendrophyses occur in the hymenium, and not as a fringe to the pulvinae as stated by Patouillard. The pulvinae are seldom perfectly discoid, but are usually elongated and irregular in shape. My impression is that they dry more or less flat, and not into the depressed, saucer-like bodies illustrated by Patouillard.

There are most impressive and detailed similarities between *Punctularia tuberculosa* and *Phlebia strigoso-zonata* (Schw.) Lloyd, which has recently been excellently redescribed and made the type species of a monotypic genus, *Phaeophlebia* W. B. Cooke (Cooke in Mycologia 48, 1956, 401).

*Punctularia tuberculosa* and *Phaeophlebia strigoso-zonata* agree in the purple-brown to blue-black colour of the hymenium when dry, and its red-brown colour when moist. They have essentially the same kind of hymenium. It tends to be pulvinate in *Punctularia* and smooth to veined in *Phaeophlebia*, but the pulvinae of the former are often elongated and parts of the latter are often almost pulvinate. Both have a hymenium which, when dry, appears minutely punctate under a lens and is full of a cementing substance composed of lightly coloured granules forming a darkish zone around and above the hymenial elements. In each, the hymenial convolutions are separated by narrow deep fissures which are sterile and contain amorphous mineral granules, sometimes forming a fringe to the papillae. Each has a subgelatinous texture, drying horny to waxy. The basidia in each are rarely found in a mature condition and are long, narrow and flexuous, with basal clamps. Sections of these two species are extraordinarily alike and no significant difference in the arrangement of the tissues can be detected, though in *Phaeophlebia* the context hyphae are perhaps a little more distinct. In both, the hymenium contains dark dendrophyses. *Phaeophlebia* is usually resupinate-reflexed or pileate; *Punctularia* is usually resupinate, but (as shown in local specimens matched with the type and bearing also the conidial stage) can become reflexed as much as 1 cm from the substratum. In each species there are hyaline, clamped hyphae forming the middle layer and there is a dark basal seam and a trichoderm of dark, thick-walled, clamped hyphae. I regard this trichoderm as an indicator of potential reflexion even in species or specimens which are normally resupinate. The margin of *Phaeophlebia* is definite; that of *Punctularia* is usually indefinite, but not always so.

*Punctularia tuberculosa* has a known conidial stage and lacks gloeocystidia; *Phaeophlebia* has no known conidial stage and possesses gloeocystidia. These features are not, in my opinion, sufficient to hold the two genera apart, while in all other respects I regard them as congeneric. Accordingly I propose to sink the genus *Phaeophlebia* W. B. Cooke under *Punctularia* Pat. and to make the combination:

***Punctularia strigoso-zonata* (Schw.) Talbot comb. nov.**

= *Merulius strigoso-zonata* Schw. in Trans. Amer. Phil. Soc. n.s. 4 (1834) 160.

*Phlebia strigoso-zonata* (Schw.) Lloyd in Lloyd Myc. Writ. 4 (1914) L. 53, p. 15;  
Talbot in Bothalia 6 (1951) 28.

*Phaeophlebia strigoso-zonata* (Schw.) W. B. Cooke in Mycologia 48 (1956) 401.

For a description of this species see W. B. Cooke (loc. cit.).

The systematic position of the genus *Punctularia* is still doubtful. *P. tuberculosa* has been placed by various authors in *Corticium* and *Thelephora*, and has been likened to *Grandinia*, *Aleurodiscus* or *Porothelium*. *P. strigoso-zonata* has previously been classified as a *Phlebia*, *Stereum*, *Auricularia* or *Phaeophlebia*. Most of these can be eliminated as not being near relatives. The nature of the hymenium, basidia, sterile structures and perhaps the spores, set *Punctularia* apart from other genera. Its holobasidia remove it from the Heterobasidiomycetes. Its structure is certainly not hydneous, nor cyphelloid. It has some brown hyphae, but does not accord with the hymenochaetoid or xanthochroic fungi. The distribution of the tissues in *Punctularia* is decidedly *Stereum*-like, though the texture and hymenium are different. Martin (in Proc. Iowa Acad. Sci. 50, 1943, 167) remarked that *Phlebia strigoso-zonata* had little in common with the Hydneae but a closer resemblance to the more fleshy species of *Merulius*. There might be a good case for the proposal of a new family to accommodate *Punctularia*, but this seems premature until the majority of the species and genera of the Thelephoraceae are known in greater detail. I would therefore place *Punctularia* provisionally in the subfamily Meruloideae of the Thelephoraceae, realising however that both the family and subfamily as now constituted are heterogeneous and artificial.

I wish to acknowledge the courteous and stimulating assistance given to me by Professor G. W. Martin and Dr. W. B. Cooke in correspondence about the genus *Punctularia*. This helped greatly in the formation of my ideas on this subject, for which, however, I accept full responsibility.

**CORTICIUM Pers. ex Fries.**

1. *Corticium abeuns* Burt in Ann. Mo. Bot. Gard. 13 (1926) 250; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 29, f. 10.

This record for South Africa rests on the specimen in Universiteit van Stellenbosch, Herbarium P. A. van der Byl, No. 1495. It was cited by Burt as a paratype of *C. abeuns*. Rogers & Jackson (in Farlowia 1, 1943, 280) have examined all Burt's paratypes of this species and concluded that the description was misleading and the paratypes confused. They identified some of the paratypes but, being mainly concerned with North American species, did not mention van der Byl's collection. This collection has been examined and is here referred to *Corticium porosum* Berk. & Curt.

2. *Corticium bombycinum* (Sommerf.) Bres.; Recorded by Doidge in Bothalia 5 (1950) 481.

One specimen is cited in support of this record, namely No. 33185, *Doidge & Bottomley*, Wolhuterskop, Boschfontein. This specimen is undoubtedly *Peniophora arenata* Talbot, and *C. bombycinum* should be omitted from South African records.

3. *Corticium lacteum* Fr.; Recorded by Saccardo, Syll. Fung. 6 (1888) 610; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 30; Doidge in Bothalia 5 (1950) 482.

No South African specimens under this name have been located and the record is based on Saccardo's mention of "Capite Bonae Spei" as one of the localities for this fungus, without giving any other details.



Rogers & Jackson (Farlowia 1, 1943, 294) give a long discussion on the status of the name *C. lacteum* Fr. and reject it as a *nomen dubium*.

4. *Corticium laetum* (Karst.) Pers.; Recorded by Lloyd, Myc. Writ. 6 (1920) 952; Doidge in Bothalia 5 (1950) 482.

Presumably the specimen sent by van der Byl to Lloyd, which is the basis of this record, is one of those in the National Herbarium, since there are none in the van der Byl Herbarium. All the specimens assigned to this species in Doidge (loc. cit.) have been examined and are referable to *Corticium salmonicolor* B. & Br., except No. 9154 which is *Helicobasidium compactum* (Boedijn) Boedijn. The material of No. 27267 is poor but may be the *Necator decretus* state of *C. salmonicolor*. This conidial stage has recently been found on *Pyrus malus* in Natal (No. 41053).

#### 5. *Corticium moniliforme* sp. nov.

FIG. 11.

Resupinate, effused over soft, dead wood, adnate, deeply and abundantly cracked down to the substratum when dry, the cracks not usually connected by subicular strands. Hymenium smooth, white, chamois or biscuit colour when dry, with a paler white, indefinite, pruinose or pellicular margin. Texture membranous-waxy. Context somewhat stratified, concolorous, 400–450  $\mu$  thick in section.

Basidia: clavate, often with a basal clamp connection, (27)–32–40  $\times$  6.5–8.5  $\mu$ , with four sterigmata.

Spores: cylindrical to elliptical, hyaline, smooth, non-amyloid, with rounded ends, 7.4–10  $\times$  3–4.8  $\mu$ .

Gloeocystidia: arising in the middle layers or below and extending into the hymenium but not emerging, originating from a system of tortuous hyphae, thin-walled, with homogeneous contents, with a cylindric-clavate basal part or cell and the superior part divided by as many as 12 constrictions into a moniliform structure with constrictions often so deep that a chain of superimposed cells is formed, with a scarcely perceptible isthmus between each. The globose cells get progressively smaller towards the apex of the gloeocystidium. Gloeocystidia 85–100  $\mu$  long and 5.7–9.6  $\mu$  wide, sometimes with a basal clamp connection.

Hyphae: (1) the system from which the gloeocystidia arise has hyaline, thin-walled hyphae, very much branched and anastomosing in a wide network, tortuous, with nodular swellings and irregular outline, septate, easily stained with phloxine, 2.8–4.3  $\mu$  wide, found throughout the context; (2) a ground tissue of hyaline, septate, thin-walled, branched hyphae, with occasional clamp connections, which do not stain and are always indistinct as they collapse easily.

Minerals: present throughout the tissues.

Specimens examined: Type, 36899, Talbot, Hennops River; 36936, Talbot, Hennops River.

The moniliform gloeocystidia suggest an *Aleurodiscus* but the relatively small basidia and small non-amyloid spores and lack of other paraphysoid structures, distinguish the present species from *Aleurodiscus*. In the genus *Corticium* I have found only two species described with moniliform gloeocystidia: *Corticium radiosum* Fr., according to Cunningham (Trans. Roy. Soc. N.Z. 82, 1954, 290) has moniliform gloeocystidia, but its spores are oval or subglobose, 8–11  $\times$  7–8  $\mu$ . *Corticium septentrionale* Burt, which is a synonym of *Corticium litschaueri* Burt (fide Rogers & Jackson in Farlowia 1, 1943, 300), also has gloeocystidia of the same type, but according to Cunningham (loc. cit. p. 293) these may project sometimes up to 14  $\mu$  and its spores are smaller, 6–8  $\times$  2.5–3  $\mu$ . It appears to differ from the new species in hyphal characters, the hyphae being much more regular, not tortuous nor collapsing.



*Corticium moniliforme* Talbot sp. nov.

Fungus resupinatus, effusus, adnatus, membranaceo-ceraceus, ut siccus profunde fissus. Hymenium leve, albidum, bubalinum vel isabellinum. Margo indefinitus, pruinosis vel pelliculosus, albidus. Basidia clavata,  $(27)32-40 \times 6.5-8.5 \mu$ , saepe ad basem nodoso-septata, sterigmatibus 4. Sporae cylindraceae vel ellipticae, hyalinae, leves, non amyloideae,  $7.4-10 \times 3.4-8 \mu$ . Gloeocystidia cellulis basalibus cylindraceo-clavatis, partibus superioribus moniliformibus, interdum ad basem nodoso-septatae, non emergentia. Hyphae (1) hyalinae, tenue tunicatae, tortuosae, anastomosae, septatae, tumoribus nodulosis inaequalibus (2) hyalinae, tenue tunicatae, ramosae, nodoso-septatae, obscurae. Typus No. 36899, leg. P. H. B. Talbot.

6. *Corticium pelliculare* Karst.; Recorded by van der Byl in Ann. Univ. Stellenbosch 7 (1929) 29; Doidge in Bothalia 5 (1950) 482.

The only specimen on which this record is based is Universiteit van Stellenbosch, Herbarium P. A. van der Byl No. 2225, Knysna. This specimen is certainly not *C. pelliculare*, but instead is readily identifiable with *Peniophora arenata* Talbot (in Bothalia 4, 1948, 945, f. 4 and Ibid. 6, 1951, 22). *Corticium pelliculare* should be eliminated from South African records.

7. *Corticium porosum* Berk. & Curt. apud Berk. & Br. in Ann. Mag. Nat. Hist. ser. v, 3 (1879) 211; Rogers & Jackson in Farlowia 1 (1943) 300; Cunningham in Trans. Roy. Soc. N.Z. 82 (1954) 295, f. 13. Further synonyms and literature references given by Rogers & Jackson, loc. cit.

## FIG. 13.

Resupinate, effused, thin, membranous, separable in small pieces when moist, white to ivory yellow, drying chamois. Hymenium cracked occasionally and smooth, or faintly tuberculate. Margin whitish, thinning out. About  $220-250 \mu$  thick in section. Basidia: clavate,  $15 \times 4 \mu$ .

Spores: ellipsoid to subglobose,  $3 \times 4 \mu$  ( $4-6-7 \times 3-4 \mu$ , fide Bourdot & Galzin), hyaline, amyloid, appearing smooth under low magnification but actually minutely roughened under oil immersion.

Gloeocystidia: mostly originating in the basal layer but some small ones are hymenial, thin-walled, sometimes the wall slightly thickened at the base, subulate to ventricose or fusiform, usually becoming narrow towards the apex, flexuous, possessing granular yellowish contents, not becoming brown in Iodine solutions, abundant,  $8-13 \mu$  wide at the base and tapering to  $3-6 \mu$  wide higher up,  $40-186 \mu$  in length.

Hyphae:  $2-3 \mu$  diam, branched, interwoven in a more or less vertical direction, not encrusted.

Specimens examined: As *Corticium abeuns* Burt: Universiteit van Stellenbosch, Herbarium P. A. van der Byl Nr. 1495, Houtbos, Tvl.

Although determined as *Corticium abeuns* by Burt, this specimen is not that species. Rogers & Jackson (loc. cit.) found that three other paratypes of *C. abeuns* were actually *Corticium porosum*. The present collection has the general structure of the *C. porosum* group and corresponds with this also in having amyloid, minutely roughened spores, and gloeocystidia which do not turn brown with Iodine. Its spores are small, being at the minimum range of size for this species. The gloeocystidia of typical examples of *C. porosum* are frequently, but not invariably, bifurcate at the base, while their apex is possibly a little less flexuous than those in the present specimen. Nevertheless the species is known to very variable in the nature of its gloeocystidia. Cunningham (loc. cit.) notes that "Practically every section examined shows a somewhat different microstructure, consequently it is advisable to regard these as forms of this variable species, as Rogers & Jackson have done. In general, thick specimens have longer gloeocystidia and more of them in the lower portions of the context".

It seems likely that this species will find general acceptance as *Gloeocystidiellum porosum* (B. & C.) Donk (see Donk in *Fungus* 26, 1956, 9).

8. *Corticium punctulatum* Cooke in *Grevillea* 6 (1878) 132; Further references and synonymy, see Rogers & Jackson in *Farlowia* 1 (1943) 320.

*Hypochnus eylesii* van der Byl (!) in *S.A. Journ. Sci.* 22 (1925) 168, in *Ann. Univ. Stellenbosch* 7 (1929) 18.

FIG. 12.

Resupinate, widely effused, hypochnoid to submembranous, not cracked, adherent, light yellowish to creamy. Hymenium pruinose, pubescent from the projecting gloeocystidia. Margin entire or pruinose. Thickness in section about 230  $\mu$ .

Basidia: clavate to cylindrical, 5.6–6.5  $\mu$  wide.

Spores: Hyaline, finely asperulate, subglobose to broad elliptic, 4.8  $\times$  5.6  $\mu$  or 4.8–6.4–8  $\mu$  diam., often uniguttulate, thin to thick-walled, very abundant, free or embedded in the context.

Gloeocystidia: embedded in all parts of the trama, some also projecting 22–64  $\mu$  above the hymenium where they are cystidioid and usually lightly encrusted with large mineral particles; the embedded gloeocystidia are smooth, thin-walled, with hyaline, homogeneous contents, ventricose to subulate or cylindrical, with a blunt, rounded apex, 13–(19)  $\mu$  wide at the base, 70–115  $\mu$  long.

Hyphae: basal hyphae clearly seen, hyaline, with frequent clamps, septate, smooth, branched, with thickened walls, 4–6.4  $\mu$  wide. Hyphae of middle layer compacted and indistinct, but apparently like the basal ones only with thinner walls.

Specimens examined: 40684 (T.R.L. 2937), *M. Mrost et al.*, on underground timbers, Venterpost Mines; 40678 (T.R.L. 2617), *A. L. Jaunes et al.*, on underground timbers, Venterpost Mines; 40682, (T.R.L. 2758) *A. L. Jaunes*, on pitch pine sills, Blyvooruitzicht Mine; As *Hypochnus eylesii* (Isotype) in Herbarium Len Verwoerd (30), Stellenbosch-Elsenburg Agric. Coll., leg *F. Eyles*, Stellenbosch, May, 1923.

These collections come clearly in the group of species which includes *Corticium albostramineum*, *Peniophora sphaerospora*, *Gloeocystidium crenicolor* and *G. eichleri*. These four are regarded by Bourdot & Galzin (Hym. de Fr., 1928, 262) as forms of *Gloeocystidium albostramineum*, and by Rogers & Jackson (*Farlowia* 1, 1943, 320) as synonyms of *Corticium punctulatum* Cooke, which we accept here as the name for this complex. Bourdot and Galzin distinguish these forms on differences in spore size, compactness of the tissues, and so on, but evidently Rogers and Jackson regard these as minor variations about a central species.

The isotype of *Hypochnus eylesii* van der Byl, apparently the only material of this species in existence, is an excellent match with *C. punctulatum*. Its tissues are more laxly intertexted than those of the specimens from Transvaal mines, while more of its spores have the walls thickened. The Transvaal material corresponds most closely with the description of *C. crenicolor* in spore size and in the compact trama, but undoubtedly the watersoaked habitat has had an effect on the appearance of this material.

9. *Corticium solani* (Prill. & Delacr.) Bourd. & Galz.; Records cited by Doidge in *Bothalia* 5 (1950) 483.

= *Pellicularia filamentosa* (Pat.) Rogers, q.v.

10. *Corticium vagum* Berk. & Curt.; Records cited by Doidge in *Bothalia* 5 (1950) 483.

= *Pellicularia vaga* (B. & C.) Rogers ex Linder, q.v.

11. *Corticium vagum* var *solani* Burt ex Rolfs; Records cited by Doidge in *Bothalia* 5 (1950) 483.

= *Pellicularia filamentoza* (Pat.) Rogers, q.v.

## PENIOPHORA Cooke.

1. *Peniophora carnosa* Burt in Ann. Mo. Bot. Gard. 12 (1925) 325; Doidge in Bothalia 5 (1950) 486.

The specimen on which this record is based is No. 27761 (*Rump*, 107). This is definitely not *P. carnosa*, which has hairlike, non-encrusted cystidia, a bright yellow hymenium and context, and occurs on coniferous wood. Instead this specimen has large, conical, encrusted cystidia and occurs on frondose wood. Though poor in condition and lacking spores it may be identified by its general structure and cystidia as *Peniophora roumeguerii* Bres., which was noted in Bothalia 6 (1951) 22, pl. 14.

2. *Peniophora cinerea* (Pers. ex Fr.) Cooke in Grevillea 8 (1880) 20, pl. 123, f. 8.; Saccardo Syll. Fung. 6 (1888) 643; Burt in Ann. Mo. Bot. Gard. 12 (1925) 353; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 16; Doidge in Bothalia 5 (1950) 486.

*Corticium cinereum* Pers. ex Fries, Epicr. Syst. Myc. (1838) 563.

Doidge cites three collections in support of this record. I have examined Universiteit van Stellenbosch, Herbarium P. A. van der Byl Nr. 326, on *Pyrus malus*, determined by Burt, loc. cit. This is a resupinate, grey member of the *Coloratae* group of *Peniophora*, and is probably referable to *P. cinerea*. But as it is very young, consisting only of primordia just emerging from the lenticels, I would wish to see further specimens before being certain that this species is represented here. In this specimen the margin is free but not reflexed, and the spores are  $11-11.5 \times 4-5 \mu$ .

No. 22044 (Fungi MacOwaniani No. 1054, Boschberg, Somerset East, as *Corticium cinereum* Fries) is a typical specimen of *Stereum umbrinum* B. & C. The copy of MacOwan 1054 in Herb. S.A. Museum No. 34248 resembles the Pretoria copy superficially but is a true species of *Hymenochaete*. It is however fragmentary and indeterminate.

3. *Peniophora cremea* Bresadola, Fungi Trid. 2 (1898) 63; Recorded for South Africa by Burt in Ann. Mo. Bot. Gard. 12 (1925) 263; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 16, f. 3; Doidge in Bothalia 5 (1950) 486.

All the specimens noted by Doidge in support of this record have been examined, and none is considered to represent *P. cremea*. The record rested originally on Burt's determination of *van der Byl* No. 612, but he was evidently in some doubt about it since this collection is annotated by van der Byl (translated), "Species unknown by Burt. In all probability *P. cremea*." The three specimens in Universiteit van Stellenbosch, Herbarium P. A. van der Byl, Nos. 612, 1468, 1488 are *Peniophora pelliculosa* Talbot, No. 1468 being the most typical. Nos. 30231 and 34359 in the National Herbarium are also *P. pelliculosa*, while No. 28288 is the type of *Corticium gloeosporum* Talbot. On present knowledge *P. cremea* is not acceptable as a South African species,

4. *Peniophora gracillima* Ell. & Everh. ex Rogers & Jackson in Farlowia 1 (1943) 317.

*Peniophora glebulosa* sensu Bresadola, Fung. Trid. 2 (1898) 61, Pl. 170, f. 2; Saccardo Syll. Fung. 16 (1902) 195; Rea, Brit. Basid. (1922) 688; Bourdot & Galzin, Hym. de Fr. (1928) 288; Burt in Ann. Mo. Bot. Gard. 12 (1925) 282; van der Byl in Univ. Stellenbosch 7 (1929) 15; van der Byl in S.A. Journ. Sci. 23 (1926) 288; Doidge in Bothalia 5 (1950) 486.

## FIG. 28.

Resupinate, effused, membranous, rather adherent, whitish to cream or yellowish, pubescent on account of the projecting cystidia, becoming cracked into small clods when dry. Margin thinner, similar or pruinose. Up to  $200 \mu$  thick in section.



Basidia: small, clavate, about  $10 \times 3.5 \mu$ .

Spores: hyaline, allantoid or cylindric-curved, smooth,  $1.5 \times 6.4-7.2 \mu$ . [(5)-9-10  $\times$  1.5-3  $\mu$  fide Bourd. & Galz.; 6-9  $\times$  1.5-2  $\mu$  fide Burt].

Cystidia: abundant, arising deep in the trama and transversing it, embedded or projecting 40-64  $\mu$  beyond the hymenium (up to 110  $\mu$  in European material); tubuliferous, cylindrical, hyaline, 60-120  $\mu$  long or longer, 7-12  $\mu$  wide, very thick-walled with a canalicular lumen which is dilated brusquely at the apex so that the apex is thin-walled. Apex rounded, smooth or often covered with granular mineral matter. Walls of the cystidia soluble in KOH, but not in lactic acid, leaving only the lumen visible. Cystidia borne laterally on basal hyphae, sometimes bifurcate at the base.

Hyphae: indistinct. The basal cystidiophores in European material are 3-5  $\mu$  wide, thick-walled, and the tramal hyphae are indistinct, 2-3  $\mu$  wide, thin-walled.

Specimens seen: Universiteit van Stellenbosch, Herbarium P. A. van der Byl, Nr. 1477, Woodbush, Transvaal.

This most interesting species has cystidia characteristic of the section Tubuliferae of *Peniophora*, whose walls are dissolved by KOH. The allantoid spores are also distinctive.

Though the species is better known as *P. glebulosa* Bres., Rogers & Jackson, loc. cit., have pointed out that this name is invalid, and they published the new species *P. gracillima* Ell. & Everh. to take its place. Malençon (in Bull. Soc. Myc. de Fr. 70, 1954, 139) gives useful notes on the taxonomy and nomenclature of this species. According to Malençon the cystidia are amyloid. Donk (in Fungus 26, 1956, pp. 13-16) retains the epithet *glebulosa* for this species and places it in a new genus *Tubulicrinis* Donk, which appears to be a distinctive and well-founded genus. He characterises the cystidia as "lyocystidia".

5. *Peniophora incarnata* (Pers. ex Fr.) Karsten; Recorded for South Africa by Doidge in Bothalia 5 (1950) 486.

The specimen for this record, Scott No. 33768, is a member of the Coloratae group of *Peniophora*, but differs from *P. incarnata* in colour and in its lack of gloeocystidia. It is close to *Peniophora versicolor* (Bres.) Sacc. & Syd., as described and figured by John Eriksson (in Symb. Bot. Uppsal. X: 5, 1950, 18) but differs in colour and in having larger cystidia. It may represent a new species, but requires further study.

6. *Peniophora longispora* (Pat.) Höhnelt var *brachyspora* Talbot & Green var. nov.

FIG. 26.

Resupinate, very thin, easily separable, pruinose-pellicular, with similar margin. Hymenium white, discontinuous, beset with emergent, hairlike, encrusted cystidia.

Basidia: clavate, usually with a basal clamp,  $13-17 \times 3-4 \mu$  with four sterigmata up to 4  $\mu$  long.

Spores: elliptic-fusoid,  $2.2-3.2 \times 6.4-8 \mu$ , hyaline, smooth, sometimes with a faint band about the middle.

Cystidia: hyaline, cylindrical to acicular, tapering to a sharp subulate apex, thin-walled, with a wartlike, denticulate, incrustation or relatively large mineral granules, arising laterally from the subhymenial hyphae and emergent for most of their length,  $3.2-3.5 \times 67-88 \mu$ .

Hyphae: hyaline, loosely intertexted, thin-walled, smooth or a little encrusted, branched, septate, with abundant clamp connections,  $2.5-3.2 \mu$  wide.

Specimens examined: Type, No. 40683 (T.R.L. 2901), *M. Mrost*, on underground timbers, Venterspost Mine, 27/vi/52.



The general aspect of this variety is very like that of *P. longispora*, but the latter is distinguished by having spores twice as long and somewhat narrower ( $1-3 \times .12-18 \mu$  fide Bourdot & Galzin), and also in having a bulbous base to many of the cystidia. The pruinose-pellicular fructifications, loose hyphae with clamps, characteristic cystidia and banding of the spores are distinctive of both. The faint banding of the spores is probably due to the formation of two polar guttules.

Another very similar fungus, possibly to be included under var *brachyspora* is No. 40979, Talbot, on *Populus deltoides*, Piet Retief. This has bulbous-based cystidia like *P. longispora*, but its spores measure  $1.6-2 \times 6.4-8 \mu$  and are cylindric-curved. That is, the spores correspond in length but not in shape with those of var *brachyspora*. Bourdot & Galzin describe several varieties of *P. longispora* with varying shapes and sizes of spores. None had spores as short as the present collections, and their length is rather constant.

The spores of *P. longispora* var *brachyspora* correspond in length with those of *Peniophora soraria* G. H. Cunn. (Cunningham in Trans. Roy. Soc. N.Z. 83, 1955, 280, f. 18) but the latter differs in having wider, less fusoid spores,  $4-5 \mu$  wide, and wider cystidia,  $5-7 \mu$  wide.

*Peniophora longispora* (Pat.) Höhnelt var *brachyspora* Talbot & Green var. nov.

Fungus resupinatus, albidus, pruinoso-pelliculatus, margine simili. Basidia clavata,  $13-17 \times 3-4 \mu$ , ad basem nodoso-septata, sterigmatibus 4, usque ad  $4 \mu$  longis. Sporae elliptico-fusoideae, hyalinae, leves, interdum virga pallida circum mediam sporam,  $2.2-3.2 \times 6.4-8 \mu$ . Cystidia hyalina, cylindracea vel acicularia, apicibus subulatis, tenue tunicata, emergentia, granis verrucosis complanatis incrustata,  $3.2-3.5 \times 67-88 \mu$ . Hyphae hyalinae, laxae intertextae, tenue tunicatae, leves vel parum incrustatae, nodoso-septatae,  $2.5-3.2 \mu$  diam. Typus No. 40683 (T.R.L. 2901), M. Mroost.

7. *Peniophora nuda* (Fries) Bresadola in I. R. Accad. Agiati Atti iii, 3 (1897) 114; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 17; Doidge in Bothalia 5 (1950) 486.

*Corticium nudum* Fries, Epicrisis Syst. Myc. (1838) 564.

*Thelephora nuda* Fries, Syst. Myc. 1 (1821) 447.

The only collection of this species recorded for South Africa is *Medley Wood* No. 161. I have not been able to trace this collection in any herbarium.

8. *Peniophora papyrina* (Mont.) Cooke in Grevillea 8 (1880) 20; South African Records cited by Doidge in Bothalia 5 (1950) 486.

*Stereum papyrinum* Montagne.

Welwitsch, Iter Angolense No. 433, cited by Doidge is a specimen of *Stereum fulvum* (Lév) Sacc., with pseudosetae derived from the ends of skeletal hyphae. *Peniophora papyrina* has a rather similar external appearance, but its skeletal hyphae are modified apically into wider, more peniophoroid cystidia resembling those of *Stereum umbrinum*.

The other specimen of *P. papyrina* mentioned by Doidge has not been traced. It seems dubious whether the species is represented in South Africa.

9. *Peniophora pruinata* (B. & C.) Burt in Ann. Mo. Bot. Gard. 12 (1925) 340; Doidge in Bothalia 5 (1950) 486.

*Stereum pruinatum* Berk. & Curt. (!) in Journ. Linn. Soc. Bot. 10 (1868) 332.

This species is discussed under *Stereum pruinatum* B. & C. in Bothalia 6 (1954), 323. The only specimen recorded for South Africa under this name, MacOwan (1227) in Herb. Kew., is not determinable, but lacks cystidia and does not match the type of *S. pruinatum* in several other respects. *P. pruinata* must be omitted from South African records.

10. *Peniophora pruinosa* (Pat.) Jackson in Canad. Journ. Res. 28 (1950) 530, f. 2.

*Corticium pruinoseum* Pat., Cat. rais. pl. cell. Tunisie (1897) 60; Saccardo, Syll. Fung. 14 (1899) 222.

*Peniophora chordalis* Höhn. & Litsch. in K. Akad. Wiss. Wien Sitzungsab. 115 (1906) 1598; Bourdot & Galzin, Hym. de Fr. (1928) 280; Wakefield in Trans. Brit. Myc. Soc. 35 (1952) 58, f. 34.

*Peniophora subgelatinosa* Litsch., Österr. Bot. Zeitschr. 77 (1928) 128. Above synonymy after Jackson loc. cit.

#### FIG. 30.

Resupinate, effuse, inconspicuous, gelatinous, to mucoid when fresh, hyaline or blue-grey, drying as a greyish vernicose film which is white-pruinose under the lens showing protruding cystidia, adnate, not more than about 50  $\mu$  thick.

Basidia: not seen (fide Jackson "cylindric or cylindric-clavate, 15-25  $\times$  7.5-8  $\mu$  with (4)-5-6-(7) short sterigmata").

Spores: hyaline, appearing smooth in KOH but actually minutely punctate all over as seen under oil immersion in lactic acid mounts, not amyloid, ovate-elliptical often with one flat side, laterally apiculate, 5-6-(7)  $\times$  3-4  $\mu$ .

Cystidia: projecting for most of their length, hyaline, smooth, not encrusted, tapering from base to rounded apex, the base thick-walled and 8-11  $\mu$  wide often showing one or two short rootlike branches, the apex thin-walled and 4.5-6  $\mu$  wide. The cystidia are 60-120  $\mu$  long and in old collections may break off leaving the thick-walled basal part behind as a short tubule.

Cystidioles: rare and not well shown in our material, but 45-50  $\times$  4  $\mu$  with a simple or shortly lobed capitate apex. (Fide Jackson, "Cylindric or tapering gradually from base to apex, 25-45-(60)  $\times$  2.5-3.5  $\mu$ , wall slightly thickened below, apex occasionally simple or capitate when young, more commonly with 3-5 short, blunt lobes").

Hyphae and Tissues: gelatinised and obscure.

Specimens examined: 39051, W. G. Rump, Town Bush Valley, Pietermaritzburg.

There is very little material of this collection but fortunately just enough to see the characteristic texture of the fructification and the spores and cystidia. No basidia and only two cystidioles were found.

This species differs from *Peniophora rimicola* (see next entry) in the smaller spores, in the apically lobed cystidioles, and in having basidia with a greater number of sterigmata.

11. *Peniophora rimicola* (Karst.) Höhnelt & Litsch. in K. Akad. Wiss. Wien Sitzungsber. 115 (1906) 1556; Bourdot & Galzin, Hym. de Fr. (1928) 281; Rogers in Univ. Iowa Stud. Nat. Hist. 17 (1935) 31; Jackson in Canad. Journ. Res. 28 (1950) 527, f. 1.

*Corticium rimicolum* Karsten in Hedwigia 35 (1896) 45; Saccardo, Syll. Fung. 14 (1899) 221.

FIG. 29.

Resupinate, effused, inconspicuous, gelatinous to mucoid when fresh, hyaline or grey-blue, drying to a grey-blue or whitish vernicose film which is white-pruinose under the lens showing numerous protruding cystidia, adnate but sometimes lifting as a vernicose flake, not more than about  $50\ \mu$  in thickness.

Basidia: not seen (fide Jackson, "cylindric or somewhat clavate,  $15-25 \times 7.5-8\ \mu$ , base usually obscure, sometimes bifurcate, bearing 2, 3 or 4 short arcuate sterigmata  $3-4\ \mu$  long").

Spores: hyaline, appearing smooth in KOH but actually minutely punctate all over as seen under oil immersion when mounted in lactic acid, not amyloid, broad ovate-elliptical, often with one side flattened, laterally apiculate,  $(5.6)-6.4-7-(8.8) \times 8-10-(12)\ \mu$ .

Cystidia: projecting for most of their length, hyaline, smooth, not encrusted, tapering from base to rounded apex, the base thick-walled and  $8-11\ \mu$  wide often showing one or two short rootlike branches, the apex thin-walled and  $4.5-6\ \mu$  wide. The cystidia are  $60-120\ \mu$  long and in old collections may break off leaving the thick-walled part as a short tubule.

Cystidioles: present but not well shown in our material. (Fide Jackson, "cylindrical or slightly clavate,  $25-35 \times 2-3\ \mu$ , simple, or more commonly capitate at the apex to  $3-5\ \mu$ ").

Hyphae and Tissues: gelatinised and obscure.

Specimens examined: 30952, *P. H. B. Talbot*, on *Eucalyptus*, Buffelspoort Expt. Stn.; 41024, *P. H. B. Talbot*, on *Populus deltoides*, Piet Retief; also collected on dead wood at Fountains, Pretoria, 24/X/1948.

These dried collections were not in prime condition for examining and describing. The basidia and hyphae were not clearly seen and the cystidioles were scanty and inconclusive, but in other essentials they agree very well with Jackson's excellent account of this species.

Jackson characterises the *P. rimicola* group by their mucous-gelatinous fructifications which are often bluish and pruinose, and dry to a vernicose film. They tend to produce marginal or superficial cordlike mycelial strands. Their tissues are gelatinised and rather featureless, but the cystidia and cystidioles are distinctive, as also are the non-amyloid minutely roughened spores. The basidia in *P. rimicola* are categorised as "pleurobasidia" by Donk (in Reinwardtia 3, 1956, 370-371).

12. *Peniophora tenuis* (Pat.) Massee in Journ. Linn. Soc. Bot. 25 (1889) 149; Burt in Ann. Mo. Bot. Gard. 12 (1926) 317; Rogers and Jackson in Farlowia 1 (1943) 322. *Corticium praetermissum* (Karst.) Bresadola in Ann. Mycol. 1 (1903) 100.

*Sebacina africana* Burt (!) in Ann. Mo. Bot. Gard. 13 (1926) 338; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 20, f. 4; Doidge in Bothalia 5 (1950) 475; McGuire in Lloydia 4 (1941) 43.

For an extensive synonymy and discussion see Rogers & Jackson loc. cit.

FIG. 27.

Resupinate, effused, adnate, whitish, becoming light creamy or isabelline. Hymenium smooth, becoming vaguely granular to almost poroid in parts, not cracking.

Margin thin, indeterminate. Thickness in section about 100–130  $\mu$ .

Basidia: subcylindric, closely compacted, 5–6.5  $\mu$  wide.

Spores: cylindrical, oblong or ellipsoid with one side flattened, not amyloid, hyaline, sometimes guttulate, 3–5  $\times$  7–10  $\mu$ .

Gloeocystidia or Cystidia: embedded in all parts of the trama but especially arising from the basal tissues, ventricose, fusiform or subcylindrical, with pale yellowish or hyaline, homogeneous contents, yellow in Iodine, very variable in size, 8.5–12  $\times$  39–135  $\mu$ ; a few of these bodies may be emergent, subcylindrical, with colourless contents, smooth or slightly encrusted, cystidioid.

Hyphae: colourless, not encrusted, very compact and difficult to distinguish, forming a dense tissue, mostly 3–5  $\mu$  wide.

Specimens examined: 39088 (T.R.L. 2436), James & Breyer, on underground timbers, C.M.R., Johannesburg, 1949.

The identification of the above specimen was confirmed by Dr. D. P. Rogers. We have followed Rogers & Jackson, loc. cit., in their interpretation of *P. tenuis* as a variable complex of species. In some of its forms it might easily be taken for a gloeocystidiolate *Corticium*; in others the emergent cystidia are more conspicuous and it is readily placed in *Peniophora*. The cystidioid organs are especially variable in size and degree of exertion, but the spores are rather characteristic of the group. The Transvaal specimen had a denser trama than is often seen in this group. The same tendency was noted in specimens of *Corticium punctulatum* recovered from underground timbers.

The type specimen of *Sebacina africana* Burt was examined in Universiteit van Stellenbosch, Herbarium P. A. van der Byl No. 1342, Knysna. The spores measured 9–13  $\times$  3–5  $\mu$ , and the other characters agree with the *P. tenuis* group, to which *S. africana* is here assigned.

13. *Peniophora velutina* (DC. ex Fr.) Cooke; Recorded by Doidge in Bothalia 5 (1950) 487.

The specimen on which this record is based, No. 27764 (*Runp* 117), is *Peniophora roumeguerii* Bres.

#### MERULIUS Haller ex Fr.

1. *Merulius confluens* Schweinitz, Naturforsch. Ges. Leipzig 1 (1822) 92; Nel in Ann. Univ. Stellenbosch 20 (1942) 77.

Nel's record of this species for South Africa is based on the specimen in Universiteit van Stellenbosch, Herbarium P. A. van der Byl Nr. 753. I am unable to differentiate this specimen from *Merulius corium* (Pers. ex Fr.) Fr. (Compare Bothalia 6, 1951, 30).

Cunningham (in D.S.I.R. New Zealand Bull. No. 83, 1950, 6) states that *M. confluens* differs from *M. corium* in having a darker hymenium with deeper pores, smaller spores, and context hyphae which are thinner-walled, often collapsing, and usually (but not always) coated with crystals.

2. *Merulius lacrymans* Wulf. ex Fries, Syst. Myc. 1 (1821) 328; Doidge in Bothalia 5 (1950) 502.

*Boletus lacrymans* Wulfen in Jacquin, Misc. Austr. 2 (1781) 111.

Mycelium loosely intertexted in a thick felted mat. fibrous, often with conspicuous strands, whitish to pale fawn coloured. Fructification resupinate, widely effused and sometimes reflexed, thick, spongy to fibrous-fleshy, readily separable from the substratum. Surface light brown to greyed-brown. Hymenium gyrose, somewhat poroid or becoming flattened-dentate or raduloid. Pores 1–2 mm diam. and about half as



deep, rust coloured, ferruginous yellow to Brussels brown or Sepia. Margin widely sterile, pale to fawn colour, more or less tomentose. Thickness in section 2 mm or more.

Basidia: clavate,  $6.4-8 \times 50 \mu$ , with 4 sterigmata; accompanied by narrow paraphysoid hyphae about  $2 \mu$  diam.

Spores: ellipsoid with one side often flattened, bright ochraceous or honey yellow,  $4.8-6.4 \times 9.6-12.8 \mu$ , frequently guttulate.

Hyphae: (1) coloured, thick-walled, with a narrow or invisible lumen,  $5.6-8-(11.2) \mu$  wide; (2) hyaline, thin-walled, with clamps,  $3-6.4 \mu$  wide, sometimes with the wall thickening slightly.

I have examined all the specimens listed under this name by Doidge (loc. cit.), and am not quite convinced that any of them is *M. lacrymans*, since they are either sterile mycelium or, if fertile, differ in being considerably darker in colour than typical *M. lacrymans*. This may be due to the way these specimens have been preserved, and I have thought it advisable to give the above description drawn up from freshly collected English material (Nos. 35772, 35927, 36685, *P. H. B. Talbot*, Richmond, Surrey, on timber in a house).

*M. lacrymans* is usually confused with *M. himantoides* in South Africa. The hymenium of the latter is not rusty-coloured but has a darker, sordid colour. Its hyphae, both hyaline and coloured, are thin-walled and they often become inflated and then collapse readily.

3. *Merulius molluscus* Fries, Syst. Myc. 1 (1821) 329; Saccardo, Syll. Fung. 6 (1888) 416; Bourdot & Galzin, Hym. de Fr. (1928) 351.

*Merulius fugax* Fries sensu Burt in Ann. Mo. Bot. Gard. 4 (1917) 352, f. 33.

*Merulius laeticolor* Berk. & Br. in Ann. Nat. Hist. n. 1681; Saccardo Syll. Fung. 6 (1888) 417.

FIG. 31.

Resupinate, effused, membranous, very soft, readily separable. Hymenium tan, creamy, pinkish buff to orange tinted, gyrose-plicate. Margin byssoid, whitish to pale buff coloured. Context soft, byssoid to fibrillose, less than  $300 \mu$  thick in section.

Basidia: clavate, sometimes with a basal clamp,  $5-9 \times 23-35 \mu$ , with four short sterigmata.

Spores: smooth, hyaline, becoming very pale yellow, oblong-ellipsoid,  $5-6 \times 3-4.5 \mu$ , commonly with 1-2 small guttules.

Hyphae:  $3.5-7 \mu$  wide, thin-walled, with abundant clamps which are often ansiform, much branched, hyaline and smooth in the upper parts but granule-encrusted and rarely pale-tinted in the basal tissues, all loosely intertexted.

Specimens examined: No. 41054, *E. L. Stephens* (679), on fir log, Cecilia Forest Plantation, Cape; Rabenhorst Fungi Europaei (No. 3034), *E. Marchal*, Belgium.

The notes given by Burt and by Bourdot & Galzin show that there is some doubt as to the typification of *M. fugax* and *M. molluscus*. I have followed Bourdot & Galzin in adopting the name *M. molluscus* for this species since it conforms closely with the good description given by Fries, whereas Fries' description of *M. fugax* is poor and could apply to several different species.

*M. molluscus* is distinctive but could possibly be confused with *M. corium* on account of its bright colour. The latter is distinguished by its hyaline spores, thick-walled hyphae lacking clamps, and effused, narrowly reflexed habit. *M. molluscus* is resupinate and at least some of its spores, sometimes the majority, are coloured a pale yellow.

4. *Merulius pinastri* (Fr.) Burt in Ann. Mo. Bot. Gard. 4 (1917) 356, f. 36; Doidge in Bothalia 5 (1950) 502.

*Hydnum pinastri* Fries, Obs. Myc. 1 (1815) 149, Syst. Myc. 1 (1821) 417.

Doidge records No. 27559, *R. Lurie*, New Modder Mine, Johannesburg, as *Merulius pinastri*. The fructification appears somewhat deformed, probably owing to the habitat, and is not determinable to species. It is not *M. pinastri* however, from which it differs in its colour and in the characters of its mycelium and spores.

5. *Merulius rufus* Pers. ex Fr.; Recorded by Doidge in Bothalia 5 (1950) 502.

One specimen only is cited in support of this record, viz. No. 27790 (*W. G. Rumpf* 86). This is quite clearly effuso-reflexed and possesses the colour and spores of *Merulius corium*. According to Burt (in Ann. Mo. Bot. Gard. 4, 1917, 338), *M. rufus* is fawn to carob-brown or Natal Brown in colour, and its spores are  $4\cdot4\cdot5 \times 1\cdot5\text{--}2\cdot5 \mu$ , and it is truly resupinate. *M. rufus* should be omitted from South African records.

6. *Merulius serpens* Tode ex Fries, Syst. Myc. 1 (1821) 327; Kalchbrenner in Grevillea 10 (1881) 57; Doidge in Bothalia 5 (1950) 502.

Kalchbrenner published a collection of *MacOwan*, Somerset East, as this species. This collection has not been traced in any herbarium and the record cannot be confirmed.

7. *Merulius tremellosus* Schrad. ex Fr., Syst. Myc. 1 (1821) 327; Doidge in Bothalia 5 (1950) 503.

This record is based on No. 1350, *E. M. Doidge*, Garstfontein, Pretoria. The specimen is clearly *M. corium* and not *M. tremellosus*, which differs in habit, the possession of very small allantoid spores, and in having a hymenium composed of radially elongated shallow pores which become transversely ridged.

### TOMENTELLA Patouillard.

1. *Tomentella punicea* (A. & S. ex Fr.) Schroet; Bourdot & Galzin, Hym. de Fr. (1928) 491.

*Hypochnus puniceus* (A. & S. ex Fr.) Saccardo, Syll. Fung. 6 (1888) 661; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 19; Doidge in Bothalia 5 (1950) 479.

*Thlephora punicea* A. & S. ex Fries, Elenchus Fung. (1828) 199; Alb. & Schw. Consp. Fung. Lusatie (1805) 278; Kalchbrenner in Grevillea 10 (1881) 58; Wood in Rept. Natal Bot. Gard. (1898) 19.

This record for South Africa is based on *J. M. Wood* No. 190 which has not been traced in any herbarium. The record is therefore doubtful. The following is a translation of the description of this species given by Bourdot & Galzin, loc. cit.

Formed of powdery granules, then confluent into a soft, floccose membrane, loosely felted, slightly adherent, red-vermilion colour rarely persistent but passing into a red-brown or brick red. Margin clear, arachnoid, or absent. Hyphae hyaline, thin-walled, clamped,  $3\text{--}6\text{--}(9) \mu$ , the basal ones tinted bistre-yellow. Basidia  $30\text{--}42\text{--}50 \times 6\text{--}7\text{--}10 \mu$ , with 2-4 more or less arcuate sterigmata  $6\text{--}8 \mu$  long. Spores globose or ovoid, rather regularly sinuolate and asperulate,  $7\text{--}8\text{--}12 \times 5\text{--}7\cdot5\text{--}9 \mu$ , 1-guttulate, hyaline, containing, as do the basidia and subhymenial hyphae, a red material which is soluble in KOH and becomes brown.

2. In *Bothalia* 6 (1951) 63 the writer listed *Hypochnus eylesii* van der Byl (in S.A. Journ. Sci. 22, 1925, 168 and in Ann. Univ. Stellenbosch 7, 1929, 18) under *Tomentella*, without having seen material of this species.

Part of the type collection of *H. eylesii* was eventually located in Herbarium Len Verwoerd (30) at the Stellenbosch-Elsenburg College of Agriculture. On study, this proved to be *Corticium punctulatum* Cooke sensu Rogers & Jackson (in Farlowia 1, 1943, 320).

### HYMENOCHAETE L  veille.

My studies of *Hymenochaete* in South Africa are incomplete and must remain so pending a wider study of the genus. The collections can quite readily be arranged in taxonomic species and it is often possible to say that a particular collection does not represent the species under which it has been recorded. Its true identity is far more difficult to establish, and in many instances this has not yet been done.

1. *Hymenochaete dregeana* (Berk.) Massee in Journ. Linn. Soc. Bot. 27 (1890) 114; Doidge in *Bothalia* 5 (1950) 484.

*Corticium dregeanum* Berk. (!) in Hooker's Lond. Journ. Bot. 5 (1846) 3.

In *Bothalia* 6 (1954) 344, the writer showed that the type of this species, *Dr  ge* 9451 c, should be referred to *Irpex dregeanus* (Berk.) Talbot.

2. *Hymenochaete fulva* Burt in Ann. Mo. Bot. Gard. 5 (1918) 354; Doidge in *Bothalia* 5 (1950) 484.

The record rests on Doidge's citation of Nos. 34356, 34386, and 35325 as this species. The first two of these are co-specific but neither they nor the last-mentioned specimen correspond with *H. fulva*. No. 35325 is close to *H. fulva* in structure, but lacks cystidia and has much smaller setae.

3. *Hymenochaete fusco-violascens* (Mont.) van der Byl in Ann. Univ. Stellenbosch 7 (1929) 14; Doidge in *Bothalia* 5 (1950) 484.

*Thelephora fusco-violascens* Mont. in Ann. Sci. Nat. ser. iii, 7 (1847) 174; Saccardo Syll. Fung. 6 (1888) 546.

This record is based on the collection of *Dr  ge* (9429) from Durban. There does not appear to be a specimen in existence. The short description, apart from the dark violaceous colour of the hymenium, could fit many different species.

4. *Hymenochaete luteobadia* (Fr.) H  hnel & Litsch. in K. Akad. Wiss. Wien Sitzungsab. 116 (1907) 754; Burt in Ann. Mo. Bot. Gard. 5 (1918) 323, f. 8; van der Byl in Ann. Univ. Stellenbosch 7 (1929) 13, f. 2; Doidge in *Bothalia* 5 (1950) 485.

*Stereum luteobadium* Fr., Epicr. Syst. Myc. (1838) 547; Saccardo, Syll. Fung. 6 (1888) 571; Kalkbrenner in Grevillea 10 (1881) 58; Bottomley in S.A. Journ. Sci. 13 (1916) 440.

### FIG. 34.

Pileate, dimidiate; surface of pileus coloured Argus Brown to Sayal Brown (Ridgway), velutinate to tomentose. Margin entire, undulating, thin, concolorous. Hymenium coloured Buckthorn Brown to Tawny Olive (Ridgway), smooth, concentrically furrowed like the abhymenial surface. Thickness in section 300-400  $\mu$ .

Basidia & Spores: not seen.

Setae:  $35-50 \times 4-6 \mu$ , scanty, in a single layer projecting above the hymenium.

Hyphae: brown, smooth,  $2 \mu$  wide.

Abhymenial hairs: similar to hyphae.

Tissue differentiation: there is a compact darker zone between the hyphae of the context and the abhymenial hairs.

Specimens examined: No. 15558, *W. Haygarth*, Ngoye (as *Stereum villosum*); 11974, *R. Dümmer*, Kyague, Uganda; 14884, *T. D. Maitland*, Gongoni, Kenya; Universiteit van Stellenbosch, Herbarium P. A. van der Byl Nrs. 146, 692, 523.

### 5. *Hymenochaete nigricans* (Lév.) Bresadola; Doidge in *Bothalia* 5 (1950) 485.

*Stereum nigricans* Léveillé in *Ann. Sci. Nat. ser. iii*, 2 (1844) 212; Saccardo, *Syll. Fung.* 6 (1888) 561.

FIG. 35.

Pileate, dimidiate; surface of pileus coloured Mars Brown to Chestnut Brown (Ridgway), thickly matted with a soft, spongy, tomentum, concentrically furrowed. Margin concolorous, undulating to slightly lobate, thin. Hymenium coloured near Mummy Brown (Ridgway), smooth, somewhat furrowed. Thickness in section (excluding surface hairs) about  $150 \mu$ .

Basidia & Spores: not seen.

Setae: in a single layer, projecting from the hymenium,  $(20)-35-40 \times (6)-8-10 \mu$ , spaced well apart.

Hyphae: brown, smooth,  $2-4.5 \mu$  wide, arranged mostly parallel to the hymenium, running out into abhymenial hairs with no dark or compact zone in between.

Abhymenial hairs: brown, smooth,  $3-5 \mu$  wide.

Specimens examined: *MacOwan*, Cap. b. sp. (sub *Stereum percome* in *Herb. Kew.*).

The specimen cited by Doidge as *H. nigricans*, No. 15558, *Haygarth*, is instead *Hymenochaete luteobadia*. The latter differs from *H. nigricans* in having longer, thinner and more delicate setae, which are also sparser, in the presence of a basal seam, in colour, and in having a thinner tomentum on the surface.

The *MacOwan* specimen cited above corresponds in detail with *Hymenochaete spadicea* Berk. which, as indicated by Bresadola (in *Ann. Mycol.* 14, 1916, 233) is a synonym of *H. nigricans*.

### 6. *Hymenochaete rubiginosa* (Dicks. ex Fr.) Léveillé in *Ann. Sci. Nat. ser. iii*, 5 (1846) 151; Burt in *Ann. Mo. Bot. Gard.* 5 (1918) 332, f. 11; Massee in *Journ. Linn. Soc. Bot.* 26 (1890) 97; van der Byl in *Ann. Univ. Stellenbosch* 7 (1929) 14; Doidge in *Bothalia* 5 (1950) 485.

*Thelephora rubiginosa* Dicks. ex Fr., *Syst. Myc.* 1 (1821) 436.

*Stereum rubiginosum* (Dicks. ex Fr.) Fr., *Epicr.* (1838) 550; Montagne in *Ann. Sci. Nat. ser. iii*, 7 (1847) 174.

The original South African record of this species was based on *Drège* No. 9450, which I have not been able to locate in any herbarium. No. 30260 cited by Doidge as this species is referred to *Hymenochaete ochromarginata* Talbot.



7. *Hymenochaete tabacina* (Sow. ex Fr.) Lév. in Ann. Sci. Nat. ser. iii, 5 (1846) 152; Doidge in Bothalia 5 (1950) 485.

*Thelephora tabacina* Sow. ex Fr., Syst. Myc. 1 (1821) 437.

*Auricularia tabacina* Sowerby, Brit. Fung. (1797) pl. 25.

Of the specimens cited by Doidge for South Africa, I have been unable to locate Cheesman, Groot Schuur. No. 27627, *Rump*, is a specimen of *Stereum umbrinum*. No. 28287, *Rump*, is a species of *Hymenochaete* but not *H. tabacina*.

The MacOwan specimen cited by Doidge under *H. tabacina* var. *australis* has not been located. This variety is held to be a synonym of *H. tabacina*.

8. *Hymenochaete tenuissima* Berk (!) in Journ. Linn. Soc. Bot. 10 (1868) 333; Doidge in Bothalia 5 (1950) 485.

Doidge cites two specimens, of which that collected by Cheesman has not been located. No. 15596, *Haygarth*, is a polypore, *Polystictus tabacinus* Mont.

9. *Hymenochaete tristicula* (B. & Br.) Masee; Doidge in Bothalia 5 (1950) 485.

= *Duportella tristicula* (B. & Br.) Reinking. See Bothalia 6 (1951) 46.

#### ODONTIA Pers. ex S. F. Gray.

1. *Odontia bicolor* (Alb. & Schw. ex Fr.) Bresadola in Ann. Mycol. 1 (1903) 87; Bourdot & Galzin, Hym. de Fr. (1928) 429, f. 115; Miller in Mycologia 26 (1934) 27, Pl. 3, f. 5; Brown in Bot. Gaz. 96 (1935) 658, f. 14; Nobles in Canad. Journ. Bot. 31 (1953) 745-749, Figs. 1-7.

*Hydnun bicolor* Alb. & Schw. ex Fr., Syst. Myc. 1 (1821) 417.

FIG. 32.

Resupinate, widely effused, pruinose to ceraceous in parts, white, becoming creamy. Margin pruinose, white to creamy, indeterminate. Teeth variable, conical, subulate or cylindrical, up to 0.4 mm long, often divided above into several points, the apices usually fimbriate, composed of sterile hyphal ends with rounded or acute tips, projecting about 50-60  $\mu$  and each 2.5-3  $\mu$  diam. Forming a profuse mycelium and white rot within the substratum.

Basidia: clavate, 15-20  $\times$  4-5  $\mu$ , with 2-4 sterigmata up to 5  $\mu$  long.

Spores: (not seen in South African material) elliptic-oblong with the base obliquely attenuated, hyaline, (5.5)-7-(8)  $\times$  (2.5)-3.3-(4)  $\mu$ .

Cystidia: capitate (1) composed of an axis (2)-4-6  $\mu$  wide and 15-20  $\mu$  long whose globose apex is surrounded by a smooth, thin-walled, globose envelope, sometimes with yellowish contents, easily collapsing, 10-20  $\mu$  diam. In some of these cystidia the end of the axis is blown out into the envelope and no columella-like part is seen; (2) other cystidia composed of a thinner axis, usually about 3  $\mu$  diam. whose enlarged end is surmounted by a crest of radiating acicular crystals about 8-12  $\mu$  diam.

Hyphae: subicular hyphae are hyaline, branched, septate, with clamps, thin-walled, 1.5-2  $\mu$  wide; the hyphae in the teeth are 2-3  $\mu$  wide, easily collapsing, hyaline, thin-walled, sometimes with clamps.

Crystals: radiating acicular crystals are abundant in all parts of the fructification.

Specimens examined: 36792, *N. Eaton*, on worked *Pinus* timber, Potchefstroom; 39046, *P. H. B. Talbot*, on *Eucalyptus*, Lions River, Natal.

The peculiar capitate and mineral-encrusted cystidia, the radiating groups of crystals, and the dense white rot of the substratum, are characters by which this species is easily recognised. Nobles describes this fungus in culture and the important rot of conifers and frondose trees that it produces.

**GRANDINIA** Fries.

1. *Grandinia rosea* P. Hennings in Engler Jahrb. 38 (1905) 108; Saccardo, Syll. Fung. 21 (1912) 379; van der Byl in Ann. Univ. Stellenbosch 12 (1934) 8.

FIG. 33.

Resupinate, widely effused, with rather soft to membranous or spongy texture, sometimes becoming crustose, coloured rosy to terra cotta or brick red. Margin fibrillose to byssoid. Hymenium covered with small (180–200  $\mu$  diam., fide Hennings) half-round tubercles or with short raduloid or more or less cylindrical teeth. The tubercles and teeth are fertile and without setoid hairs or cystidia.

Basidia: cylindric-clavate, about  $19-29 \times 3-4 \mu$ , with usually 2 very short sterigmata ( $14-18 \times 3.5-5 \mu$  fide Hennings).

Spores: subglobose to ovate, or elliptical with one side flattened, hyaline, smooth,  $3.2 \times 4.8 \mu$  ( $4.5 \times 4 \mu$  fide Hennings).

Hyphae: (1) layer next to substratum composed of compact horizontal adherent hyphae with firm walls, septate, colourless, tending to collapse,  $3-7 \mu$  wide; (2) middle and upper tissues of colourless, branched, septate, collapsing hyphae,  $4-6.5 \mu$  wide, arranged more or less vertically and more loosely than the basal layer. No hyphae are very clear. Airspaces common in the middle layers.

Specimens examined: Universiteit van Stellenbosch. Herbarium P. A. van der Byl Nr. 706.

This is a distinctive species on account of its colour, soft and membranous to spongy texture, and hyphae which are mostly widely spaced. *Grandinia* may not be the most suitable genus for this species, but a better one cannot yet be suggested.

**SISTOTREMA** Fries emend. Donk.

1. *Sistotrema muscicola* (Pers.) Lundell apud Lundell & Nannfeldt in Fung. Exsicc. Suecici Fasc. xxix-xxx (1947) 11, No. 1415 a.

*Hydnum muscicola* Pers., Myc. Eur. 2 (1825) 181.

*Grandinia muscicola* (Pers.) Bres. apud Bourd. & Galz. in Bull. Soc. Myc. Fr. 30 (1914) 252, Hym. de Fr. (1928) 411, f. 112.

*Trechispora muscicola* (Pers.) Rogers in Mycologia 36 (1944) 83, f. 3.

FIG. 36.

Fructifications resupinate, consisting of delicate spines up to 1 mm long borne on a separable pellicular to membranous subiculum, fragile, cream to ochraceous in colour, with a pellicular, paler, sterile margin. The fructification is occasionally poroid.

Basidia: Obovate when immature, later becoming urnigerous, with a short, subcylindrical apical protrusion, not expanded at the apex,  $13-20 \times 6.4-6.8 \mu$ , with (4)–6 short sterigmata up to  $3.5 \mu$  long.

Spores: subglobose to broad ovate or ellipsoid, shortly attenuated at the base,  $2.7-3.6 \times 2.3-2.7 \mu$ , smooth, hyaline ( $4.5.5 \times 3.3.5 \mu$ , fide Rogers;  $3-4.5 \times 2.5-4 \mu$ , fide Bourdot & Galzin;  $3-4.5 \times 3.5 \mu$  fide Lundell).

Hyphae: thin-walled, smooth, hyaline, readily collapsing in parts, with large, inflated clamp connections up to  $7-10 \mu$  wide, the rest of the hyphae being only  $2.5-5.5 \mu$  wide.

Specimens examined: 40671, *Distr. Forest Officer*, on dead *Pinus pinaster* near soil level, Knysna, Woodville Plantation.

In the specimen examined, the spores are somewhat smaller than as usually described for this species, but there appears no doubt as to its identity. Rogers (Loc. cit.) separated *Trechispora* for resupinate species with urnigerous basidia, from *Sistotrema* which he limited to pileate species. This treatment is not supported by Lundell, nor by Eriksson (Svensk. Bot. Tidskr. 43, 1949, 312). I have here followed the Swedish view, since it seems in this instance that the distinction between resupinate and pileate species is too slight to be of generic significance. (See also Donk in *Fungus* 26, 1956, 4.).

2. *Sistotrema brinkmanni* (Bres.) J. Eriksson in K. fysiogr. Sällsk. Lund Forh. 18 (1948) 17.

*Odontia brinkmanni* Bres. in Ann. Mycol. 1 (1903) 88.

*Trechispora brinkmanni* (Bres.) Rogers & Jackson in Farlowia 1 (1943) 288; Rogers in Mycologia 36 (1944) 88.

*Corticium coronilla* Höhn. apud Höhn. & Litsch. in Ann. Mycol. 4 (1906) 291; Biggs in Mycologia 29 (1937) 686.

FIG. 38.

Fructification resupinate, very thin and delicate, pruinose to waxy or later thin membranous, drying inconspicuous, white to yellowish, the hymenium even or minutely papillate, the margin pruinose or finely fibrillose, sometimes accompanied in culture by dark sclerotia or bulbils.

Basidia: 13·5–16·5  $\mu$  long, formed in clusters, urniform, composed of a swollen base 4–5  $\mu$  wide, often with a subtending clamp connection, and a long narrower apical part 2·7–3·8  $\mu$  wide expanded somewhat below the corona of (4)–6–8 sterigmata. Sterigmata curved, about 3·5  $\mu$  long.

Basidiospores: ellipsoid to subcylindric, usually unilaterally depressed or flattened, apiculate, smooth, 4·4–5·4  $\times$  1·9–2·6  $\mu$ .

Hyphae: thin-walled, smooth, with abundant large clamps, (1·9)–4·5–7  $\mu$  wide becoming inflated into ampoullar hyphae at the clamps.

Bulbils: deep brown or light yellowish-brown, subspherical, 67–122  $\mu$  diam., composed of aggregated yellow-brown subspherical cells.

Other organs: Spherical cells 8–10  $\mu$  diam., hyaline, eventually detached. These are in the nature of chlamydospores and are produced in some cultures. Cylindrical, hyaline oidia are found in other cultures.

Specimens examined: 41739, V. C. Green, on imported Southern Pine beams in storage at West Rand Consolidated Mines, 22/3/57.

An extensive synonymy and description of this species is given by Rogers (1944) and Biggs (1937).

This collection was noted in the form of bulbils on timber intended for use in the mines, and the above description is drawn up from cultures made from the bulbils by Miss V. C. Green.

#### MISCELLANEOUS ADDENDA.

1. *Irpex dregeanus* (Berk.) Talbot and *Irpex vellereus* B. & Br.

D. A. Reid (in Kew Bull., 1955, pp. 631–648) holds *Irpex vellereus* apart from *I. dregeanus*, while acknowledging a very close relationship between the two species.

He differentiates them as follows:—

*Irpex vellereus*.—Spores 4·5–6  $\times$  2·5–3  $\mu$ ; Cystidia 3·5–5  $\mu$  wide.

*Irpex dregeanus*.—Spores 6·5–7  $\times$  4·5–5  $\mu$ ; Cystidia (5)–6–8  $\mu$  wide.

## 2. Synonymy of Various *Stereum* Species.

P. L. Lentz (in U.S. Dept. Agric. Agriculture Monograph No. 24, 1955, pp. 1-74) gives the following synonyms:—

<i>Stereum diaphanum</i> (Schw.) Cooke	=	<i>Cotilydia diaphana</i> (Schw.) Lentz.
<i>Stereum bicolor</i> (Pers. ex Fr.) Fr.	=	<i>Laxitextum bicolor</i> (Pers. ex Fr.) Lentz.
<i>Stereum umbrinum</i> B. & C.	=	<i>Laxitextum crassum</i> (Lév.) Lentz.
<i>Stereum fasciatum</i> (Schw.) Fr.	}	= <i>Stereum ostrea</i> (Blume & Nees ex Fr.) Fr.
<i>Stereum lobatum</i> (Kunze ex Fr.) Fr.		
<i>Stereum concolor</i> (Jungh.) Mont.		
<i>Stereum perlatum</i> Berk.		

## 3. *Lopharia*.

G. H. Cunningham (in Trans. Roy. Soc. N.Z. 83, 1956, 621) has emended the genus *Lopharia* Kalchbr. & MacOwan to contain pileate species of the Thelephoraceae bearing pedicellate cystidia. He typifies the emended genus by *Thelephora cinerascens* Schw., disregarding the fact that the type species of *Lopharia* was, and must remain, *L. lirellos* Kalchbr. & MacOwan as this genus was monotypic when it was proposed. In my opinion the structure of *Lopharia* is stereoid rather than peniophoroid, despite the presence of cystidia, and I would therefore retain *Stereum cinerascens* as a *Stereum*. However, if it should be necessary to differentiate it from *Stereum* because of the presence of cystidia, *S. cinerascens* is the type species of *Lloydella* Bres. which was differentiated from *Stereum* precisely because it possessed "metuloid" cystidia. On the other hand, *Lopharia* and *Thwaitesiella* Massee were originally erected on the nature of the hymenial configuration, which is variable and unreliable, and they would be better sunk under *Stereum* or *Lloydella* depending upon the emphasis given to the presence of the cystidia. It appears that Cunningham was not justified in emending *Lopharia* when *Lloydella* stands for exactly the same generic concept. Cunningham treats two species under his emended *Lopharia*, viz., *L. cinerascens* (Schw.) G. H. Cunn. and *L. vinosa* (Berk.) G. H. Cunn. (Syn. *Stereum umbrinum* B. & C.; *Thelephora crassa* Lév.). He thus associates a monomitic, typically resupinate species lacking a basal seam, with a dimitic, typically effuso-reflexed species possessing a basal seam. It is true that *Stereum umbrinum* is ill-placed in *Stereum*, and for that reason I would rather follow Lentz (U.S.D.A. Agric. Monogr. No. 24, 1955) in placing it in *Laxitextum* Lentz, if it is not to be retained in *Stereum*.

## 4. *Laeticorticium* Donk.

In proposing the new genus *Laeticorticium*, Donk (in Fungus 26, 1956, 16-17) makes the combinations *L. roseum* (Pers. ex Fr.) Donk and *L. polygonioides* (Karst.) Donk. These two species were treated previously under *Aleurodiscus* (in Bothalia 6, 1956, 470), but *Laeticorticium* appears to be a well-founded genus. Donk refers to the nodular dendroid hyphae as "dendrohyphidia".

## 5. *Scytinostroma* Donk.

In two previous papers (Bothalia 4, 1948, 939 and Ibid. 6, 1951, 54, Pl. 38) the author erred in using the generic name *Asterostromella* Höhn. & Litsch. (1907), since this is based on the same type as the earlier genus *Vararia* Karst. (1903). Donk has now proposed (in Fungus 26, 1956, pp. 19-22) the genus *Scytinostroma* Donk, to which he refers *Asterostromella duriuscula* (B. & Br.) Talbot, *Asterostromella rumpiana* Talbot and *Corticium portentosum* B. & C., at the same time differentiating this genus from *Vararia*.



## SUMMARY OF THE RECORDED SOUTH AFRICAN THELEPHORACEAE.

This paper concludes a series of studies designed to revise the chaotic records of the South African Thelephoraceae principally at the specific and generic levels. The revision, carried out over a period of ten years, was based on a study of virtually every species, and the vast majority of preserved specimens, of the Thelephoraceae recorded for South Africa. Of necessity the results have been published in a number of apparently disconnected papers, and so it seems appropriate at this stage to summarise them by means of a key to the accepted species and a species-index of all the recorded South African Thelephoraceae. This is, however, only a beginning; there must still be a great number of other Thelephoraceae in this country awaiting collection and identification.

## A KEY TO THE ACCEPTED GENERA AND SPECIES OF SOUTH AFRICAN THELEPHORACEAE.

## 1. Homobasidiomycetae, Aphyllophorales, Thelephoraceae:

Basidiocarp pezizaeform, patelliform, cupulate or tubular, sessile or stipitate, the interior of the basidiocarp lined by the hymenium which may be smooth or wrinkled. Basidiocarps solitary to gregarious or confluent, at times seated on or embedded in a common floccose to membranous subiculum or stroma. . . . Subfamily Cyphelloideae 2.

Basidiocarp resupinate, effuso-reflexed or pileate. Hymenium spread over shallow veins, anastomosing ridges, or sometimes imperfectly poroid from anastomosis of the veins. Texture usually soft, fleshy or subgelatinous. . . . Subfamily Meruloideae 3.

Basidiocarp resupinate, effuso-reflexed or pileate, sessile or stipitate. Hymenium smooth or finely rugose or somewhat tuberculate, or bearing sterile hyphal pegs. Subfamily Thelephoroideae 4.

(Hymenium corticioid, hydroid or polyporoid. Basidia urniform, i.e. with a bulbous base and a narrower tubular prolongation with a crown of (4)–5–8 sterigmata 1. *Sistotrema*.)

## 2. Subfamily Cyphelloideae:

Subiculum present as a membranous stroma in which are seated contiguous cupular basidiocarps. . . . 2. *Porothelium*.

Subiculum absent. Basidiocarps discoid, patelliform or effused, coriaceous to fleshy-gelatinous. Hyphae usually gelatinised. Basidia and spores usually large. Paraphysoid structures common. . . . 3. *Cytidia*.

Subiculum sometimes absent, if present then composed of floccose interwoven hyphae. Basidiocarps usually cupulate to tubular, sometimes patelliform. . . . 4. *Solenia* and *Cyphella*.

(Compare also 16. *Aleurodiscus* and 18. *Dendrothele*.)

## 3. Subfamily Meruloideae:

Hymenium covering plane to convex, discoid to elongated pulvinae separated by narrow sterile clefts containing mineral matter, and seated on a fleshy or subgelatinous stroma. Resupinate or reflexed to dimidiate. Hymenium containing brown or yellow dendrophyses and cemented by brownish granules. Tissue distribution *Stereum*-like. Gloeocystidia present or absent. One species produces abundant conidia. . . . 5. *Punctularia*.

Hymenium covering shallow anastomosing veins or pleats, alveolar or irregularly poroid; resupinate or pileate, often rather gelatinous. . . . 6. *Merulius*.

## 4. Subfamily Thelephoroideae:

Hyphae brown, spores brown, setae or pseudosetae (setoid hyphae) absent. . . . 5.

Hyphae brown, spores hyaline, setae or pseudosetae present (guard against taking intrusive skeletal hyphae or coloured cystidia as setae or pseudosetae). . . . 6.

Hyphae hyaline or only faintly coloured, if the latter then the spores are hyaline; setae or pseudosetae absent; other ancillary organs may be present or absent. . . . 7.

5. Spores smooth; hymenophore resupinate, more or less membranous. . . . 7. *Coniophora*.

Spores verrucose or echinulate; hymenophore resupinate, floccose. . . . (*Hypochnus*) = 8. *Tomentella*.

Spores verrucose to echinulate; hymenophore compact, subresupinate to usually pileate. . . . 9. *Thelephora*.

6. Setae present..... 10. *Hymenochaete*.  
 Setae absent; pseudosetae present; gloeocystidia and cystidia also found at suitable stages of development, but often not seen..... 11. *Duportella*.  
 Asteroetae present, see..... 17. *Asterostroma*.
7. Hymenophore effuso-reflexed to pileate, occasionally resupinate but then showing tissues differentiated into a hymenium separated from the basal mycelium by a more or less horizontal middle layer. Hyphae hyaline to faintly coloured, rarely dark. Spores hyaline, smooth, rarely stippled-punctate. Texture coriaceous to sub-ligneous..... 8.  
 Hymenophore resupinate with margin rarely free or only narrowly reflexed. Hyphae usually hyaline, loosely interwoven or if compact then more or less vertically arranged and lacking a differentiated middle layer. Spores hyaline, smooth. Texture arachnoid, pellicular, byssoid, membranous, or fleshy, not coriaceous to subligneous..... 9.
8. Hymenium smooth or irregularly rugose; Hyphae normal, capillary..... 12. *Stereum*.  
 Hymenium smooth or irregularly rugose; Hyphae dendrophytic to dichophytic. Spores mostly subglobose and smooth or minutely stippled..... 14. *Asterostromella*.  
 Hymenium covering radiating costate ribs and generally also coarsely papillate. Hyphae normal, capillary..... (*Cladoderris*) = 13. *Cymatoderma*.
9. Basidia not in a palisade, formed in loose botryose clusters from lateral branches of loosely interwoven repent hyphae. Texture arachnoid to pellicular, with generally wide, distinct hyphae, usually branching at right angles. Septate cystidia occasionally present..... 15. *Pellicularia*.  
 Basidia forming a palisade hymenium above a more compact trama..... 10.
10. Basidia usually very large; spores usually large and often amyloid. Paraphysoid structures of various sorts (Acanthophyses, moniliform gloeocystidia, dendrophyses, pseudophyses) present..... 16. *Aleurodiscus*.  
 Basidia and spores not usually large and seldom amyloid. Ancillary organs present or absent..... 11.
11. Asteroetae present..... 17. *Asterostroma*.  
 Asteroetae absent..... 12.
12. Hyphal pegs present, composed of dendrophytic hyphae..... 18. *Dendrothele*.  
 Hyphal pegs absent..... 13.
13. Hyphae dendrophytic to dichophytic..... 14. *Asterostromella*.  
 Hyphae normal, capillary, not prolifically branched..... 14.
14. Possessing cystidia and sometimes cystidioles and/or gloeocystidia as well.... 19. *Peniophora*.  
 Lacking cystidia; sometimes possessing gloeocystidia and/or cystidioles..... 20. *Corticium*.

### THELEPHORACEAE (Pers.) Saccardo.

Saccardo, Syll. Fung. 11 (1895) 115.

*Thelephoreae* Persoon, Myc. Eur. 1 (1822) 109.

Hymenomycetes with inferior hymenium; hymenophore resupinate effuso-reflexed or pileate, sessile or stipitate. Hymenial layer smooth or rugulose or papillate, with continuous or discontinuous basidia, homobasidiate, frequently possessing various ancillary organs. Spores unicellular, smooth or sculptured, hyaline or coloured. Hyphae hyaline or coloured, with or without clamp connections, forming mono- or dimitic hyphal systems.

**Genus 1.** *Sistotrema* Pers. ex Fr., Syst. Myc. 1 (1821) 426, emend. Donk apud Rogers in Univ. Iowa Stud. Nat. Hist. 17 (1935) 19.

Fructification resupinate or reflexed to pileate. Hymenium smooth, granulose, toothed or poroid. Texture arachnoid, pellicular or membranous. Hyphae hyaline, with clamps. Basidia urniform, with a bulbous base and a narrower tubular prolongation bearing apically a crown of (4)–5–8 sterigmata. Spores smooth. Gloeocystidia present in some species.

The species of this genus show hymenial characters which are associated with several different Friesian families. The genus is included here because some of its species may be sought in the Thelephoraceae.

1. Resupinate, hydroid with delicate spines up to 1 mm long. Basidia not closely clustered.  
Spores subglobose or ellipsoid. .... *Sistotrema muscicola*.
- Resupinate, even or at most granular-papillate, lacking spines. Basidia closely clustered.  
Spores ellipsoid to subcylindric. Bulbils, swollen cells (chlamydospores) or oidia  
often present in culture. .... *Sistotrema brinkmanni*.

**Genus 2. *Porotheleum* (Fr. ex Fr.) Fries, Syst. Orb. Veg. (1825) 80.**

Fructifications composed of sessile, closely aggregated and confluent cupules, partly immersed in a membranous stromatic subiculum. Hymenium smooth, lining the interior of the cupules. Spores hyaline. Hyphae monomitic, hyaline, with clamps.

A single South African species, *Porotheleum incanum*.

**Genus 3. *Cyrtidia* Quelet, Fl. Myc. de Fr. (1888) 25.**

Hymenophores cupulate, sessile, centrally attached, coriaceous to fleshy-gelatinous, discrete, gregarious or confluent, sometimes effused. Hymenium lining the interior of the cupules, smooth, sometimes becoming wrinkled or veined. Spores hyaline or lightly coloured, amyloid. Hyphae usually gelatinised, with clamps, monomitic. Paraphysoids or cystidia present or absent.

1. Spores large, ovate or broad elliptical, at first hyaline, later pale coloured with the wall thickening to  $2.5\ \mu$  and penetrated by peg-like projections of the lumen. Fusoid, encrusted cystidia present. .... *Cyrtidia habgallae*.  
Spores otherwise; Cystidia absent. .... 2.
2. Spores of one kind only, cylindrical to allantoid,  $1.5-3 \times 7-10\ \mu$ . Cupular hairs long and floccose. .... *Cyrtidia flocculenta*.  
Spores of two kinds (a) cylindrical or allantoid,  $2.2-5-(3.2) \times 6.4-9.6-(11.2)\ \mu$ ,  
(b) ovate to elliptic-depressed,  $4.8-6.4 \times 9.6-12.8\ \mu$ . Cupular hairs short and scanty. .... *Cyrtidia simulans*.

**Genus 4. *Solenia* Pers. ex Fr., Syst. Myc. 2 (1823) 200; Persoon in Roemer Neues Mag. Bot. 1 (1794) 116, Syn. Fung. (1801) 675, Myc. Eur. 1 (1822) 334.**

***Cyphella* Fries, Syst. Myc. 2 (1823) 201.**

Pilei cupulate, tubular or discoid, discrete or gregarious, sometimes confluent, sessile or stipitate, naked or covered with hyaline or coloured hairs, seated sometimes upon a hyphal subiculum. Hymenium smooth, lining the concave interior of the cupules. Spores hyaline or coloured. Hyphae monomitic, hyaline or coloured, with clamp connections.

*Cyphella* is an untenable name. The old basis of separating these genera on the presence or absence of the subiculum and the discreteness of the basidiocarps cannot stand; these characters vary in a single collection. For species see the following combined key for both genera.

1. Fructifications cupular to tubular, sessile or shortly stalked. .... 2.  
Fructifications discoid with reflexed margin (i.e. patelliform). Encrusted villose hairs on reflexed part. Spores cylindrical, straight or curved,  $3.2-4.8 \times (6.4)-8-11\ \mu$ . .... *Cyphella applanata*.
2. Fructifications villose, with long hairs on the exterior. .... 3.  
Fructifications pruinose with short, sparse hairs or mineral encrustations, or nude, or with hairs mostly appressed. .... 4.

3. Spores smooth, broad ovate to pip-shaped,  $11.2-14.4 \times 9.9-6-(11.6) \mu$ . Cupules 1-3 mm diam. .... *Cyphella albobiolascens*.  
 Spores finely asperulate, ovoid,  $12-15 \times 7-8 \mu$ . Cupules 1 mm diam., later becoming flattened. .... *Cyphella cheesmani*.
4. Hairs appressed, spirally twisted in the outer half. Cupules tubular, adnate in sheaves.  
 Spores  $3-4 \times 2.5-3.5 \mu$ . .... *Solenia natalensis*.  
 Hairs, if present, not spirally twisted. .... 5.
5. Spores hyaline. .... 6.  
 Spores lightly coloured. .... 7.
6. Spores ovate to subglobose,  $4.8-6.4 \mu$  diam., smooth or minutely punctate. Cupules  $0.3-1.5$  mm diam., not hairy, pruinose with mineral deposits, greyish-white. .... *Cyphella farinacea*.  
 Spores ovate, smooth, somewhat flattened on one side,  $3-4 \times 2.5-3.5 \mu$ . Cupules up to  $0.5$  mm diam., creamy yellow, with solid, parallel, appressed surface hairs. .... *Solenia rhoina*.  
 Spores subglobose to broad ovate, smooth,  $3-4 \times 2.5-3 \mu$ . Cupules  $130 \mu$  diam.,  $250 \mu$  long, yellowish when dry, lacking surface hairs. .... *Solenia mininia*.
7. Cupules up to 1 mm high, lacking a subiculum. Hyphae thick-walled,  $3-4.8-(6.4) \mu$  wide. .... *Cyphella pelargonii*.  
 Cupules up to  $600 \mu$  high, commonly seated on a reddish-brown hyphal subiculum which may be scanty or absent. Hyphae thin-walled,  $1.6-2.4 \mu$  wide. .... *Cyphella variolosa*.

**Genus 5. Punctularia** Patouillard apud Pat. & Lagerh. in Bull. Herb. Boiss. 3 (1895) 57, pl. 2, Figs. 1, a-g.

Hymenophore resupinate, rarely narrowly reflexed, or dimidiate, subgelatinous, drying ceraceous to corneous. Hymenium covering discoid to elongated, hemispherical pulvinae seated upon a common foundation tissue and separated by sterile fissures containing mineral matter. Basidiospores hyaline to pale coloured, smooth. Dark dendrophyses present in hymenium. Hyphae subgelatinous, hyaline, with clamps. Abhymenial hairs dark brown, with clamps. Gloeocystidia present or absent. Conidial stage often present; conidia coloured, sculptured, formed in an acropetal chain separated by narrower, clamped, portions. Hymenial tissues cemented together by brownish granular material.

1. Mostly resupinate or only narrowly reflexed, usually associated with a prolific conidial state. Hymenium containing dark dendrophyses composed of a hyaline stem and an irregularly swollen, shortly branched, coloured apical part up to  $5.4 \mu$  wide. Gloeocystidia absent. .... *Punctularia tuberculosa*.  
 Resupinate-reflexed to dimidiate, lacking any known conidial state. Hymenium containing yellow, irregularly branched dendrophyses  $1-2 \mu$  wide, whose ultimate branches are thread-like. Yellow gloeocystidia present,  $3.5-5 \mu$  wide. .... *Punctularia strigosozonata*.

**Genus 6. Merulius** Haller ex Fries, Syst. Myc. 1 (1821) 326.

Fructifications resupinate, effuso-reflexed or pileate, fleshy-gelatinous, coriaceous or membranous. Hymenium at first plane then gyrose-plicate, porose-reticulate, or sometimes dentate or raduloid, fertile on the edges of the folds or teeth. Hyphae monomitic or dimitic, coloured or hyaline, with or without clamp connections. Spores hyaline or coloured, smooth.

1. Hymenium pale to pinkish or orange. .... 2.  
 Hymenium dark, some shade of yellow or brown. .... 3.
2. Spores oblong-ellipsoid, hyaline to pale yellow,  $5-6 \times 3-4.5 \mu$ . Hyphae abundantly clamped. .... *Merulius molluscus*.  
 Spores subcylindrical,  $2.5-3.5 \times 6-7.5 \mu$ , hyaline. Hyphae lacking clamps. .... *Merulius corium*.
3. All hyphae thin-walled, hyaline or coloured. .... 4.  
 Some hyphae thick-walled and coloured, lacking clamps; others hyaline with thin or slightly thickened walls, with occasional clamps. Hymenium ferruginous-yellow then darker. .... *Merulius lacrymans*.



4. Hymenium more or less smooth and Dresden Brown colour when dry, changing rapidly to warm russet and becoming convoluted when moistened. Basal hyphae often granule-encrusted. Young parts lacking a lilaceous tint..... *Merulius gelatinosus*.  
Hymenium convoluted when dry, umber to warm Brussels Brown or darker. No marked colour change when wetted. Young parts often with a pale lilaceous tint.  
Basal hyphae not granule-encrusted..... *Merulius himantoides*.

**Genus 7. Coniophora** DC. ex Pers., Myc. Eur. 1 (1822) 153; De Candolle Fl. Fr. 6 (1815) 34.

*Coniophorella* Karsten, Finl. Basidsv. (1889) 438.

Fructifications resupinate, pellicular, fleshy or membranous. Hymenium smooth or somewhat tubercular, usually some shade of yellow or brown. Spores coloured yellowish to brown, smooth. Hyphae hyaline or coloured, with or without clamp connections, forming mono- or dimitic systems. Septate cystidia sometimes present.

1. Coloured, septate, encrusted cystidia present. Spores  $(5)-6-7-(8) \times (10)-12-(14) \mu$   
Cystidia absent..... *Coniophora olivacea*. 2.
2. Basal hyphae not encrusted, narrow ( $\pm 2 \mu$ ), dark-coloured, the remaining hyphae lightly coloured or hyaline. Hymenium papillate, dark drab colour. Spores  $4-6 \times 7-5-10 \mu$ ..... *Coniophora papillosa*.  
Basal hyphae not dark, or if slightly so then  $3-(6) \mu$  wide, forming a soft spongy abhy-menial surface..... 3.
3. Basal hyphae thickly encrusted with minerals, hyaline to pale coloured, inflated then collapsing. Hymenium light brown to warm sepia or bister. Spores  $(5-6)-6-6-(8) \times (8-8)-9-6-11 \mu$ ..... *Coniophora incrustata*.  
Basal hyphae not encrusted, not inflating then collapsing..... 4.
4. Fructification fleshy-membranous, easily separable from the substratum. Hymenium tubercular..... 5.  
Fructification floccose then pellicular-membranous, arid, not readily separable. Hymenium smooth. Spores  $10-13 \times 6-7 \mu$ . Hyphae pale coloured or hyaline, the marginal ones with whorled clamps..... *Coniophora arida*.
5. [Spores  $(5-3)-6-5-8 \times 9-12-14-7 \mu$ . Basal hyphae not specially dark... *Coniophora puteana*.  
Spores  $5-6-6-6 \times 6-6-7-5-8-3-10 \mu$ . Basal hyphae dark, forming a spongy layer, the rest of the hyphae hyaline..... *Coniophora fodinarum*.

**Genus 8. Tomentella** Patouillard, Hym. d'Eur. (1887) 154.

*Hypochnus* Fries, Syst. Myc. 3 (1829) 289 emend Karsten, Rev. Myc. 3 (1881) 23.

Fructifications resupinate, soft, floccose to membranous, or adnate and crustose. Hyphae laxly intertexted, hyaline to coloured, monomitic, with clamps. Hymenium smooth or papillate. Spores coloured, verrucose, asperulate, angular.

A single species, *Tomentella punicea*, recorded from South Africa.

**Genus 9. Thelephora** Erhart ex Fries, Syst. Myc. 1 (1821) 428, pr. parte; Erhart, Crypt. Exsicc. No. 178 (1785).

Fructifications effuso-reflexed and encrusting to dimidiate, imbricate, confluent, sessile or shortly stipitate, sometimes the pileus divided into somewhat clavarioid branches, membranous to soft coriaceous. Hymenium inferior, or amphigenous in parts, smooth or somewhat papillate. Spores coloured, echinulate or verrucose, angular. Hyphae monomitic, with clamp connections, mostly dark coloured.

1. Fructifications effused, encrusting, resupinate then emitting oblique or suberect flabellate fascicles of penicillate branches, especially at the margin. Spores  $4-8-7-2 \times 6-4-9-6 \mu$ ..... "*Thelephora penicillata*" Lloyd.  
Fructifications effuso-reflexed, or dimidiate, imbricate, confluent, sessile or shortly stipitate. Surface usually strigose. Spores  $7-8 \times (7)-9-11 \mu$ ..... *Thelephora terrestris*.

**Genus 10. *Hymenochaete*** Lévillé, Ann. Sci. Nat. ser. iii, 5 (1846) 150.

Fructifications resupinate, reflexed or pileate, usually sessile, rarely stipitate, annual or perennial, arid-crustose to coriaceous. Hymenium smooth, penetrated by setae. Hyphae coloured, darkening in colour on application of alkali, dimitic or monomitic, lacking clamp connections. Spores hyaline, smooth.

1. Setae found throughout the tissues and commonly arranged in fascicles. Fructification resupinate. .... *Hymenochaete fasciculata*.  
Setigerous layer(s) differentiated from hyphal layer(s). Setae not fasciculate. Fructifications resupinate or dimidiate. .... 2.
2. Setae rather scanty, confined to the hymenium. .... 3.  
Setae abundant, forming a thick setigerous layer above the rest of the hyphal layers. .... 4.
3. Setae  $35-50 \times 4-6 \mu$ . Hymenium Buckthorn Brown to tawny olive (Ridgway).  
Tomentum thin. Compact zone differentiated at the base of the trama. Dimidiate  
*Hymenochaete luteobadia*.  
Setae  $(20)-35-40 \times (6)-8-10 \mu$ . Hymenium near Mummy Brown (Ridgway). Tomen-  
tum thick. No compact basal zone differentiated. Dimidiate. .... *Hymenochaete nigricans*.
4. Resupinate. Setigerous layer(s)  $\pm 260 \mu$  thick, sometimes arranged in strata. Setae  
 $45-70 \times 5.6-8.4 \mu$ . Hyphae moniliform in parts. .... *Hymenochaete semistupposa*.  
Usually effuso-reflexed to dimidiate and imbricate, sometimes resupinate. Setigerous  
layer  $\pm 160 \mu$  thick. Setae  $30-45 \times 6-8 \mu$ . Hyphae not at all moniliform. Margin  
conspicuous ochre colour. Abhymental surface soft, rubbing ochraceous. .... *Hymenochaete  
ochromarginata*.

**Genus 11. *Duportella*** Patouillard in Philippine Journ. Sci. 10 (1915) 87.

Fructifications resupinate, brown. Hymenium velutinate at first, later becoming tubercular and cracked. Pseudosetae (modified ends of skeletal hyphae) present. Gloeocystidia and cystidia present at some stage of development, sometimes not seen. Hyphae dimitic, almost hyaline to brown, with clamps, not forming a notably differentiated basal layer. Spores hyaline, ellipsoid to subcylindric-curved, smooth.

A single South African species, *Duportella tristicula*. But *Stereum fulvum*, which differs in having no gloeocystidia or cystidia, is possibly congeneric and should be compared.

**Genus 12. *Stereum*** Persoon ex S. F. Gray, A Natural Arrangement of British Plants 1 (1821) 652; Persoon in Roemer Neues Mag. Bot. 1 (1794) 110, Obs. Myc. 1 (1796) 35.

Fructifications coriaceous, membranous or subligneous, sessile, stipitate, effuso-reflexed or resupinate, or dimidiate, or infundibuliform, simple or branched. Stipe lateral, central or absent. Hymenium inferior, smooth, sometimes rugose or exceptionally tubercular. Context with an intermediate layer of  $\pm$  horizontally arranged hyphae. Spores hyaline, smooth. Cystidia, gloeocystidia or vesicles present or absent. Annual or perennial, lignicolous or terrestrial. Hyphae monomitic or dimitic, usually hyaline, with or without clamps.

1. Pilei infundibuliform and centrally stipitate. .... 2.  
Pilei not infundibuliform nor centrally stipitate. .... 7.
2. With gloeocystidia (some may be interpreted as smooth cystidia). .... 3.  
Without gloeocystidia. Here may be located some rare forms of *Stereum lobatum*  
which are infundibuliform by fusion and thus often partially split down one side.
3. Without surface hairs. Sections do not show any well-marked, denser coloured zone  
beneath the abhymental surface. .... 4.  
With (scanty) surface hairs. Sections show a well-marked denser coloured zone beneath  
the abhymental surface. Here are located some unusual forms of *Stereum affine*  
which are only infundibuliform by fusion and are often split down one side.

4. Spores small, ovate, broad-elliptic or subglobose, not larger than  $3.4 \times 4.5 \mu$ ..... 5.  
Spores larger, in the range of  $3.6 \times 6.5-9 \mu$ ..... 6.
5. Gloeocystidia up to  $12.8 \times 144 \mu$  in size..... *Stereum ravenelii*.  
Gloeocystidia smaller, up to  $10.5 \times 80 \mu$ ..... *Stereum nitidulum*.
6. Gloeocystidia usually rather narrow ( $3.2-9.6 \mu$  wide) and often hyphoid. Hyphae of two types, some with clamp connections..... *Stereum thozetii*.  
Gloeocystidia usually wider ( $8-9.6-16 \mu$  wide) and clavate. Hyphae of only one type and without clamps..... *Stereum diaphanum*.
7. Pilei laterally stipitate, or flabellate or spatulate, or sessile and cuneate attached by a markedly reduced base..... 8.  
Pilei dimidiate or effuso-reflexed or resupinate..... 13.
8. Fresh pilei bleeding red when bruised. Conducting vessels present in fresh and dried plants, seen microscopically..... *Stereum australe*.  
Fresh pilei not bleeding. Conducting vessels absent..... 9.
9. Without gloeocystidia or cystidia..... 10.  
With gloeocystidia or cystidia, or both together..... 11.
10. Pilei small (up to 1 cm in any direction) soft, whitish, without colour zones on the surface. Spores pip-shaped or later distorted and angled. Hyphae monomitic.. *Stereum cyphelloides*.  
Pilei large, coriaceous or tough, surface coloured with zones of grey, brown, chestnut. Spores cylindric-depressed. Hyphae dimitic..... *Stereum lobatum*.
11. With gloeocystidia but no cystidia; Pilei with a definite stipe, flabellate, spatulate or infundibuliform..... *Stereum affine*.  
With both gloeocystidia and cystidia..... 12.
12. Pilei usually merismatoid, i.e. a compound fructification consisting of a number of smaller pilei growing together in a bush. Gloeocystidia  $7-10 \times 40-66 \mu$ .. *Stereum involutum*.  
Pilei not merismatoid, but single or sometimes dimidiate or fused laterally. Gloeocystidia smaller,  $7-12 \times (15)-25-(40) \mu$ . Here is located the species represented by *Stereum bellum* and *Stereum friesii* in the sense used by van der Byl.
13. Without cystidia, cystidioles, gloeocystidia, vesicles or conducting organs (distinguish carefully between skeletal hyphae which intrude into the hymenium and conductors or cystidia)..... 14.  
With any of the following organs: cystidia, cystidioles, gloeocystidia, vesicles or conducting vessels (avoid locating here species which have intrusive skeletal hyphae unless these are much swollen like cystidia at the apex)..... 18.
14. Mature pilei small (1 cm or less) soft, whitish, azonate. Spores pip-shaped becoming angularly distorted. Hyphae monomitic..... *Stereum cyphelloides*.  
Mature pilei larger, or if immature then either not whitish or possessing more than one type of hypha..... 15.
15. Skeletal hyphae in context brown. The skeletal hyphae which curve up into the hymenium are brown, rugose or encrusted. Hymenium usually dark-coloured, only rarely yellowish or light coloured. (Compare also *Stereum umbrinum* where the skeletal hyphae are much expanded and resemble cystidia in the hymenium)..  
Skeletal hyphae in context not brown, but hyaline or at most only pale straw-coloured. Hymenium not dark, usually creamy, yellow, orange, fawn or sometimes changing to cinereous..... 16.
16. Pileus with multicoloured zones on the surface, usually flabellate, or if a uniform brown colour then the pilei are relatively large and flabellate..... *Stereum lobatum*.  
Pileus without multicoloured zones on the surface, or zoned in shades of brown; usually smaller than *S. lobatum* and effuso-reflexed or dimidiate, not flabellate..... 17.
17. Pileus thin, coriaceous, effuso-reflexed or dimidiate with a shortly villose or matted hairy surface..... *Stereum hirsutum*.  
Pileus thicker, usually more than 1 mm thick, corky or subligneous, effuso-reflexed, with a thick padlike tomentum of ochraceous to golden hairs..... *Stereum durbanense*.



18. Fresh pilei bleeding red when bruised. Fresh or dried specimens possessing conductors in the hymenium. .... 19.  
Fresh pilei not bleeding; lacking conductors. .... 21.
19. Pilei generally dimidiate or cuneate with a reduced base, rarely widely effuso-reflexed. Hyphae dimitic. Hymenium cinereous smooth. .... *Stereum australe*.  
Pilei mostly resupinate-reflexed, rarely dimidiate. .... 20.
20. Hymenium rimose, i.e. blistered and cracking into small rough areas, yellow, tan or cinereous. Not on conifers. Hyphae dimitic. Usually more than 700  $\mu$  thick  
*Stereum rimosum* var *africanum*.  
Hymenium smooth, not rimose, cinereous to light brown. Occurring on conifers.  
Hyphae monomitic. Usually less than 600  $\mu$  thick. .... *Stereum sanguinolentum*.
21. Species possessing pyriform or subglobose vesicles embedded deep in the trama (some of the vesicles are sometimes elongated and must be differentiated from gloeocystidia). .... 22.  
Species without vesicles. .... 23.
22. Fructifications more or less resupinate, sometimes narrowly reflexed, stratose with a veined or marbled subligneous context and a glabrous black abhymenial surface showing as a black line in wholly resupinate specimens. Hymenium yellowish  
*Stereum murrayi*.  
Fructifications effuso-reflexed or dimidiate, not stratose or veined, with a hairy brownish surface. Hymenium purple to purple-brown. .... *Stereum purpureum*.
23. Species with cystidia but lacking gloeocystidia. .... 24.  
Species with gloeocystidia and sometimes cystidia as well. .... 25.
24. Cystidia large (12–24  $\mu$  wide) conical or fusoid, encrusted, hyaline or only dilutely coloured. Spores averaging  $6 \times 11 \mu$ . Hymenium light coloured. .... *Stereum cinerascens*.  
Cystidia dark yellow-brown, subhyaline where emergent, actually only apically swollen and encrusted or rugose skeletal hyphae (rarely smooth at apex). Spores  $3.4 \times 6.8 \mu$ . Hymenium usually umber-brown or purplish, rarely a light sandy brown. (Compare *Stereum fulvum*, whose skeletal hyphae in the hymenium are less like cystidia, being not much expanded and roughly cylindrical). .... *Stereum umbrinum*.
25. Species with gloeocystidia but no cystidia. .... 26.  
Species with both gloeocystidia and cystidia. .... 27.
26. Context pale creamy to pale yellow-brown, usually stratose. Spores subglobose, 6–7  $\mu$  diam. (Gloeocystidia sometimes seen with difficulty). Hyphae dichophytic (See under *Asterostromella duriuscula*). .... *Stereum duriusculum*.  
Context brown contrasting with a hyaline hymenial layer. Spores  $3.4.5 \times 2.3 \mu$ . Gloeocystidia abundant, sometimes fragmented and refractile like cystidia. Hyphae capillary, normal. .... *Stereum bicolor*.
27. Cystidia and gloeocystidia clearly differentiated. Context pale coloured throughout. Hyphae hyaline. Here may be located the species represented by *Stereum bellum* and *Stereum friesii* in the sense of van der Byl.  
Only gloeocystidia present, the older ones fragmented and highly refractile thus resembling cystidia or mineral aggregations. Context brown, contrasting with a hyaline hymenial layer. Basal hyphae mostly brown. .... *Stereum bicolor*.

**Genus 13. Cymatoderma** Junghuhn in Tijdschr. Nat. Gesch. Phys. ed. v. d. Hoeven & De Vries 7 (1840) 390.

*Cladoderris* Pers. ex Berk. in Hooker Lond. Journ. Bot. 1 (1842) 152.

Fructifications coriaceous, flabellate to infundibuliform, sessile, substipitate or stipitate. Surface radially sublamellate with scanty hairs or covered with a thick tomentum. Hymenium radially costate, frequently coarsely papillate. Context with a basal layer of horizontally arranged hyphae and a middle layer of more or less vertical ones. Hyphae dimitic, hyaline, with clamp connections. Spores hyaline, smooth. Gloeocystidia and/or cystidia present.



1. Pileus deeply dissected into narrow radiating segments. Hyphae monomitic. Cystidia and gloeocystidia absent. Basidia with 2-4 sterigmata. Spores  $4.8-6.4-8 \mu$ . (This is a species of *Clavulina* or *Aphelaria*)..... *Cladoderris funalis*. Pileus entire to shortly lacinate at the margin. Hyphae dimitic. Cystidia and/or gloeocystidia present..... 2.
2. (Gloeocystidia present, cystidia absent. Spores  $\pm$  subglobose,  $2 \times 4 \mu$  or  $3-4 \mu$  diam..... *Cladoderris dendritica*). Both gloeocystidia and cystidia present. Spores ellipsoid,  $3.5 \times 6-10 \mu$ .. *Cymatoderma elegans*.

**Genus 14. *Asterostromella*** Höhnelt & Litsch., K. Akad. Wiss. Wien. Sitzungsab. 116 (1907) 773.

Fructifications resupinate, annual or perennial (becoming stratoze) coriaceous to subligneous. Hymenium smooth. Hyphae monomitic, hyaline to faintly coloured, with clamp connections, dichophytic to dendrophytic. Context with a basal layer of horizontal hyphae and a middle layer of  $\pm$  vertical hyphae. Gloeocystidia present in most species. Spores smooth or minutely stippled, hyaline or faintly coloured, often subglobose.

1. Context white or light yellowish; hyphae dendrophytic, hyaline. Sections not darkening in KOH. Spores  $6-6.8 \mu$  diam., subglobose..... *Asterostromella duriuscula* (= *Scytinostroma duriusculum* fide Donk; see p. 160). Context not light coloured; hyphae dendrophytic, hyaline or very dilutely coloured. Sections darkening slightly in KOH. Spores elliptic-oval,  $5.5 \times 8.3 \mu$  *Asterostromella rumpiana*. (Referred to *Scytinostroma* by Donk; p. 160).

**Genus 15. *Pellicularia*** Cooke in Grevillea 4 (1876) 116 sensu Rogers in Farlowia 1 (1943) 96.

*Botryobasidium* Donk in Nederl. Myc. Ver. Med. (1931) 116.

Fructifications resupinate, arachnoid, pellicular or loosely membranous. Hymenium discontinuous. Hyphae monomitic, with or without clamp connections, hyaline or dilutely coloured, wide, short-celled, branching at right angles. Basidia in terminal botryose clusters, bearing 4-6-8 sterigmata. Spores smooth or sculptured, hyaline or pale yellowish. Cystidia or septocystidia present or absent. Saprophytic or parasitic.

1. Spores rough-walled, ellipsoid, minutely asperulate. Clamps lacking.... *Pellicularia asperula*. Spores smooth..... 2.
2. Encrusted septocystidia present. Hyphae encrusted with wartlike granules, about  $6 \mu$  wide. Spores subglobose to broad ovate-elliptical,  $5.7-5 \times 4.5-6 \mu$ ... *Pellicularia fodinarum*. No septocystidia present. Hyphae not encrusted. Spores otherwise..... 3.
3. Saprophytic. Spores navicular or asymmetrically fusiform,  $9.6-12.8 \times 4.5-6 \mu$ . Hyphae up to  $13 \mu$  wide..... *Pellicularia vaga*. Parasitic. Spores ellipsoid, flattened on one side, with a truncate apiculus,  $8-12 \times 5-7 \mu$ . Hyphae  $5-12$ -(17)  $\mu$  wide..... *Pellicularia filamentosa*.

**Genus 16. *Aleurodiscus*** Rabenhorst ex Schroeter, Krypt.-Fl. Schlesien 3 (1888) 429.

Fructifications resupinate, or narrowly reflexed, or pileate, discoid, pezizaeform or flabellate, coriaceous. Hymenium smooth, pulverulent. Hyphae hyaline, with or without clamp connections. Basidia usually rather large to very large. Spores hyaline, smooth or echinate. Simple paraphyses, dendrophyses, acanthophyses and gloeocystidia frequently present singly or in combination.

1. Both yellowish gloeocystidia and encrusted dendrophyses present together. Amyloid granules encrusting the dendrophyses. Spores broad elliptic to ovate,  $13.5-15 \times 7.5-8 \mu$ ..... *Aleurodiscus botryosus*. Either gloeocystidia or dendrophyses present, or both absent. Spores otherwise..... 2.

2. Spores semilunate, biapiculate, smooth or minutely echinate, about  $14 \times 23 \mu$ . Acanthophyses and simple unbranched paraphysoids present. .... *Aleurodiscus mirabilis*.  
Spores otherwise. .... 3.
3. Fructifications whitish or light coloured but not rosy, purplish, violet, lilac or brownish to clay-coloured. .... 4.  
Fructifications rosy, purplish, violet, lilac or brownish to clay-coloured. .... 6.
4. Spores ovate-subglobose,  $18-22 \times 12.5-16 \mu$ . Simple cylindric paraphysoids and gloecystidioid submoniliform paraphysoids present. .... *Aleurodiscus disciformis*.  
Spores not more than  $8 \mu$  broad. Encrusted dendrophyses and bulbous pseudophyses with a short to long apical outgrowth present. .... 5.
5. (Spores ovoid,  $5.6-6.4 \times 8-12 \mu$ , ratio length/width less than 2.0. .... *Aleurodiscus acerinus*.)  
Spores broad elliptic to ovate,  $4-8 \times 9-17.6 \mu$ , ratio length/width more than 2.0  
*Aleurodiscus acerinus* var *alliaceus*.
6. Fructifications rose-coloured, paling to a fleshy tint on storage. .... *Aleurodiscus roseus*.  
Fructifications purplish, violet, lilac or partly changing to brown or clay-coloured  
*Aleurodiscus polygonioides*.

**Genus 17. *Asterostroma*** Masee in Journ. Linn. Soc. Bot. 25 (1889) 154.

Fructifications resupinate. Hymenium somewhat pulverulent, smooth. Hyphae hyaline to pale coloured, loosely intertexted, some being modified into astero-setae which are deep brown in colour. Gloecystidia commonly present. Spores hyaline, smooth, or sculptured. Hyphal system monomitic, lacking clamp connections.

A single South African species, *Asterostroma cervicolor*.

**Genus 18. *Dendrothele*** Höhnelt & Litsch., in K. Akad. Wiss. Wien Sitzungsab. 116 (1907) 819.

Fructifications resupinate or narrowly reflexed, effused or discoid, membranous. Hymenium pulverulent, smooth except for emergent hyphal pegs composed of delicate dendrophytic hyphae which are also present in the hymenium. Hyphae hyaline, with clamp connections. Spores hyaline, smooth.

A single South African species, *Dendrothele duthieae*.

**Genus 19. *Peniophora*** Cooke in Grevillea 8 (1879) 20.

Fructifications resupinate, usually pellicular to membranous or crustose, occasionally gelatinous-mucoid. Hyphae hyaline,  $\pm$  vertically arranged, with or without clamp connections. Spores smooth or rarely minutely punctate under oil immersion, hyaline. Cystidia present, simple or septate, encrusted or smooth. Gloecystidia and/or cystidioles present or absent.

1. Context yellow-buff to isabelline colour, turning strong violet colour immediately on application of KOH solution. .... *Peniophora filamentosa*.  
No violet colour reaction with KOH solution. .... 2.
2. Texture gelatinous-mucoid, drying to a very thin greyish or bluish vernicose film.  
Spores smooth in KOH but minutely punctate in lactic acid under oil immersion lens. .... 3.  
Texture otherwise; spores otherwise. .... 4.
3. Cystidioles simple or with a capitate apex composed of a few short lobes. Spores  $5.6-(7) \times 3-4 \mu$ . .... *Peniophora pruinosa*.  
Cystidioles simple or with a unbranched inflated capitate apex. Spores  $(5.6)-6.4-7-(8.8) \times 8-10-(12) \mu$ . .... *Peniophora rimicola*.
4. Cystidia septate, often with clamp connections at the septa. .... *Peniophora aspera*.  
Cystidia not septate. .... 5.

5. Cystidia long cylindrical, acicular or subulate, sometimes with a bulbous base, coated with scale-like, flattened granules. Spores  $2.2-3.2 \times 6.4-8 \mu$ , elliptic-fusoid or somewhat allantoid. *Peniophora longispora* var *brachyspora*.  
Cystidia and spores otherwise. 6.
6. Cystidia occupying a relatively narrow zone confined to the hymenium and subhymenium. 7.  
Cystidia basal or staged throughout the trama, or at least originating in mid-trama, but not confined to the uppermost layers in a distinct zone. 8.
7. Cystidia in a zone  $70-100 \mu$  thick above a byssoid trama of thick-walled hyphae.  
Cystidia encrusted, fairly thin-walled,  $20-36-(40) \times 10-13 \mu$ . *Peniophora pelliculosa*.  
Cystidia thick-walled, heavily encrusted,  $36-80 \times 10-11.5 \mu$ ; Tramal hyphae indistinct, not loose and byssoid. *Peniophora gigantea*.
8. Cystidia smooth, thin-walled or thick-walled. 9.  
Cystidia encrusted, thick-walled. 10.
9. Cystidia thick-walled, the lumen canalicular below but brusquely dilated at the apex.  
Walls of the cystidia soluble in KOH but not in lactic acid. Spores allantoid *Peniophora gracillina*.  
Cystidia thin-walled, gloecystidioid. Spores oblong or cylindrical or ellipsoid-flattened,  $3-5 \times 7-10 \mu$ . *Peniophora tenuis*.
10. Hyphae distinct,  $3-6 \mu$  wide. Spores  $2.5-3 \times 6-8 \mu$ . Cystidia  $6-10 \times 50-120 \mu$  *Peniophora arenata*.  
Hyphae indistinct, agglutinated,  $3 \mu$  wide. Spores  $3 \times 5.5 \mu$ . Cystidia  $10-16 \times 50-70 \mu$ . *Peniophora roumeguerii*.

**Genus 20. Corticium** Persoon ex Fries, Epicr. Syst. Myc. (1838) 556; Persoon, Myc. Eur. 1 (1822) 128, *pr. parte*.

Fructifications resupinate, effused, pellicular, byssoid, membranous. Hymenium smooth. Hyphae monomitic, hyaline, with or without clamp connections, arranged more or less vertically. Spores smooth (or sculptured), hyaline (or pale coloured). Cystidia absent. Cystidioles, gloecystidia, simple paraphysoids present or absent. Embedded vesicles or ampoule hyphae present or absent.

1. Species with gloecystidia. 2.  
Species with cystidioles. 6.  
Species without gloecystidia or cystidioles. 7.
2. Gloecystidia moniliform, originating from tortuous hyphae. Spores cylindrical to ellipsoid,  $7.4-10 \times 3.4-8 \mu$ . *Corticium moniliforme*.  
Gloecystidia not moniliform. 3.
3. Spores amyloid, minutely roughened under oil immersion,  $3.4 \times 4.6-7 \mu$ . Gloecystidia frequently bifurcate at the base (but not always), not turning brown in Iodine solution. *Corticium porosum*.  
Spores not amyloid; smooth or finely asperulate. 4.
4. Spores finely asperulate, subglobose to broad elliptical,  $4.8 \times 5.6 \mu$  or  $4.8-6.4-8 \mu$  diam., often embedded in the context. Texture hypochnoid. *Corticium punctulatum*.  
Spores smooth. 5.
5. Gloecystidia numerous, immersed, with bright yellow contents. Spores  $4.5 \times 9-11.5 \mu$ . *Corticium luteocystidiatum*.  
Gloecystidia immersed, hyaline, often capped by amber coloured resinous globules; spores  $3.4 \times 7-10 \mu$ . *Corticium pallidum*.
6. Cystidioles rare, immersed or slightly emergent, hyaline, sometimes with a subapical septum; spores pip-shaped, usually agglutinated,  $3.4 \times 5.5-6.5 \mu$ . *Corticium gloeosporum*.
7. Fungus bright blue colour throughout. *Corticium caeruleum*.  
Fungus not at all blue. 8.

8. Basal hyphae thick-walled, very distinct,  $6-11.5 \mu$  wide. Spores  $6.5-8.3 \times 10-13 \mu$ . Hymenium rosy, paling to flesh colour, smooth or cracked into areoles connected by whitish subiculum..... *Corticium salmonicolor*.  
Basal hyphae less than  $5 \mu$  wide, may be indistinct..... 9.
9. Spores large, in the range of  $10-16 \times 6-8 \mu$ ..... 10.  
Spores smaller, in the range of  $4.5-9 \times 3-5 \mu$ ..... 11.
10. Hymenium waxy, smooth, apricot to cinnamon-buff colour. Spores  $6-6.7 \times 10-16 \mu$ ..... *Corticium armeniacum*.  
Hymenium waxy, whitish, like candle grease when fresh, smooth, seldom cracked, drying buff to light pinkish-buff. Spores oblong-subspherical,  $7-8 \times 10-11.5 \mu$ , with prominent apiculi..... *Corticium confluens*.
11. Hymenium cracking into flaky areoles with whitish subiculum, dirty white to light tan colour. Spores  $5-7(9) \times 3.5(5) \mu$ ..... *Corticium scutellare*.  
Hymenium tuberculate, reddish-ochre with liver-brown tubercles and pale margin. Context dingy yellow. Spores  $3-4.2 \times 4.5-5.5 \mu$ ..... *Corticium tumulosum*.

#### SPECIES INDEX OF RECORDED SOUTH AFRICAN THELEPHORACEAE.

In the Index presented below, all the species of the Thelephoraceae that have been recorded for South Africa are listed alphabetically under their specific epithets, followed by the genus and author citations. Names printed in capitals are of species accepted as occurring in South Africa; those printed in small letters are rejected as not occurring here, or as synonyms, or as dubious records which can neither be confirmed nor denied.

Following each name there is a reference to the paper or papers in *Bothalia* in which the writer has described, discussed or annotated the species, each paper being cited by the volume and page number of this journal. In the case of rejected or dubious species a brief reason is given for their disposal as such.

*abeuns*, *Corticium* Burt: 6, p. 19; 7, p. 143.

Specimen not *C. abeuns*, but instead is *Corticium porosum*.

*acerina*, *Thelephora* (Pers.) Pers. ex Fr.: 6, p. 62; 7, p. 123.

= *Aleurodiscus acerinus* or its variety *alliaceus*.

*acerinum*, *Stereum* (Pers. ex Fr.) Fr.: 7, p. 123.

= *Aleurodiscus acerinus* or its variety *alliaceus*.

*acerinus*, *Aleurodiscus* (Pers. ex Fr.) Höhnelt & Litsch.: 6, pp. 26, 28, 466. No material traced.

ACERINUS var ALLIACEUS, ALEURODISCUS (Quel.) Bourd. & Galz.: 6, pp. 26, 466.

*acerinus* var *longisporus*, *Aleurodiscus* Höhnelt & Litsch.: 6, pp. 26, 467.

= *Aleurodiscus acerinus* var *alliaceus*.

*adnatum*, *Stereum* Lloyd: 6, pp. 39, 45, 304.

= *Stereum rimosum* var *africanum*.

AFFINE, STEREUM Lév.: 6, p. 304.

*affinis*, *Punctularia* (B. & C.) Talbot: 6, p. 25; 7, p. 140.

= *Punctularia tuberculosa*.

*africana*, *Sebacina* Burt: 7, p. 152.

Type is referable to *Peniophora tenuis* group.

*albobadium*, *Stereum* (Schw. ex Fr.) Fr.: 6, pp. 45, 305.

Material not this species.

ALBOVIOLASCENS, CYPHELLA (Alb. & Schw. ex Fr.) Karst.: 6, p. 471.

*amoenum*, *Stereum* Kalchbr. & MacOwan: 6, p. 305.

= *Stereum kalchbrenneri*; = *Stereum hirsutum*.

APPLANATA, CYPHELLA Talbot: 6, p. 472.

ARENATA, PENIOPHORA Talbot: 4, p. 944; 6, p. 22.

*argillaceum*, *Corticium* Höhnelt & Litsch.: 6, p. 13.

*nomen nudum*; = *Corticium pallidum*.

ARIDA, CONIOPHORA (Fr.) Karst.: 7, p. 138.



- ARMENIACUM, CORTICIUM Sacc.: 6, p. 16.  
 ASPERA, PENIOPHORA (Pers.) Sacc.: 6, p. 21.  
 ASPERULA, PELLICULARIA Rogers: 7, pp. 137.  
 atrocinerea, Coniophora (Karst.) Karst.: 7, p. 138.  
     = *Coniophora olivacea*.  
 atrocinerea, Coniophorella Karst.: 6, p. 35.  
     = *Coniophora olivacea*.  
 atrocinerea, Peniophora Massee: 6, pp. 43, 44.  
     = *Stereum fulvum*.  
 atrocinereum, Corticium Kalchbr.: 6, pp. 19, 44.  
     *nomen nudum*; = *Stereum fulvum*.  
 atrocinereum, Stereum (Massee) van der Byl: 6, pp. 43-45, 306.  
     = *Stereum fulvum*.  
 AUSTRALE, STEREUM Lloyd: 6, p. 306.  
 australica, Cladoderris Berk. ex Sacc.: 7, p. 121.  
     = *Cymatoderma elegans*.  
 australis Kalchbr. f. minima Bres., Cladoderris: 7, p. 120.  
     The material is *Stereum thozetii*.  
 bellum, Stereum (Kunze) Sacc.: 6, p. 307.  
     Doubtful as to species. The species is the same as van der Byl's material of "*Stereum friesii*".  
 betulae, Coniophora (Schum.) Karst.: 6, p. 36; 7, p. 138.  
     The specimen is the type of *Coniophora incrustata*.  
 BICOLOR, STEREUM (Pers. ex Fr.) Fr.: 6, pp. 39, 308.  
     [Syn. *Laxitextum bicolor* (Pers. ex Fr.) Lentz: 7, p. 160].  
 biennis, Thelephora Fr.: 6, pp. 62, 309, 316; 7, p. 123.  
     MacOwan's specimens are *Stereum bicolor*.  
 bombycinum, Corticium (Sommerf.) Bres.: 6, p. 19; 7, p. 143.  
     The specimen is *Peniophora arenata*.  
 BOTRYOSUS, ALEURODISCUS Burt: 6, p. 467.  
 bresadolleanum, Stereum Lloyd: 6, p. 309.  
     = *Stereum involutum*.  
 BRINKMANNI, SISTOTREMA (Bres.) J. Eriksson: 7, p. 159.  
 CAERULEUM, CORTICIUM (Schrader ex Pers.) Fr.: 6, p. 15.  
 calceum, Corticium Fr. sensu Romell & Burt: 6, pp. 19, 27.  
     *nomen confusum*.  
 calceum Fr. var. lacteum Fr., Corticium: 6, pp. 19, 27.  
     *nomen confusum*; MacOwan's material is the type of *Aleurodiscus acerinus* var. *longisporus*.  
 calix, Thelephora Kze.: 7, p. 121.  
     Specimen corresponds with *Cymatoderma elegans*.  
 candida, Solenia Pers.: 6, p. 480.  
     Material is the type of *Solenia natalensis*.  
 capensis, Aleurocystus Lloyd ex Stevenson & Cash: 6, p. 465.  
     *nomen provisorium*; = *Cytidia habgallae*.  
 capensis, Aleurodiscus Lloyd: 6, p. 468.  
     = *Cytidia habgallae*.  
 capensis, Gloeosoma Lloyd (as 'McGinty'): 6, p. 479.  
     *nomen provisorium*; = *Cytidia habgallae*.  
 caperatum, Stereum Lloyd: 6, pp. 309, 340.  
     = *Stereum turgidum*; = *Stereum cinerascens*.  
 carnosae, Peniophora Burt: 7, p. 147.  
     Material is *Peniophora roumeguerii*.  
 ceraceum, Corticium Berk. & Ravenel ex Massee: 6, pp. 16, 19.  
     *nomen nudum*; = *Corticium armeniacum*.  
 cerebella, Coniophora Pers.: 7, p. 139.  
     = *Coniophora puteana*, but the South African specimens are not that.  
 cerussatus, Aleurodiscus (Bres.) Höhnelt & Litsch.: 6, pp. 28, 468.  
     Material is *Aleurodiscus botryosus*.

- CERVICOLOR, ASTEROSTROMA (B. & C.) Massee: 6, p. 54.
- CHEESMANNI, CYPHELLA Massee: 6, p. 472.
- CINERASCENS, STEREUM (Schw.) Massee: 6, pp. 40, 309, 339-346.  
(= *Lopharia cinerascens* fide Cunningham: 7, p. 160.)
- cinerea, Peniophora (Fr.) Cooke: 6, p. 24; 7, p. 147.  
Doubtful. Some specimens are *Stereum umbrinum*, some *Hymenochaete* spp., while others may be *Peniophora cinerea* in an immature condition.
- cinereum, Corticium Pers. ex Fr.: 6, p. 19.  
= *Peniophora cinerea*.
- cinereum, Stereum Lév.: 6, p. 310.  
Doubtful. Material not traced.
- concolor, Stereum Jungh.: 6, p. 310.  
= *Stereum lobatum* (= *Stereum ostrea* fide Lentz: 7, p. 160.).
- CONFLUENS, CORTICIUM (Fr.) Fr.: 6, p. 18.
- confluens, Merulius Schw.: 6, pp. 30, 33; 7, p. 152.  
Specimens not distinguished from *Merulius corium*.
- CORIUM, MERULIUS (Pers. ex Fr.) Fr.: 6, p. 30.
- cornea, Cytidia Lloyd: 6, p. 476.  
= *Cytidia habgallae*.
- corneus, Aleurodiscus Lloyd: 6, p. 468.  
= *Cytidia habgallae*.
- CORNUCOPIOIDES, CRATERELLUS (Linn. ex Fr.) Pers.: 7, p. 117.
- cremea, Peniophora Bres.: 6, p. 25; 7, p. 147.  
Specimens are *Peniophora pelliculosa* and *Corticium gloeosporum*.
- curreyi, Cyphella B. & Br.: 6, p. 472.  
= *Cyphella albviolascens*.
- CYPHELLOIDES, STEREUM B. & C.: 6, p. 311.
- decretus, Necator Massee: 6, p. 18; 7, p. 144.  
Conidial stage of *Corticium salmonicolor*.
- dendritica, Thelephora Fr.: 7, p. 121.  
South African specimen corresponds with *Cymatoderma elegans*.
- DIAPHANUM, STEREUM (Schw.) Cooke ex Sacc.: 6, p. 311.  
[Syn. *Cotylidia diaphana* (Schw.) Lentz: 7, p. 160.].
- DISCIFORMIS, ALEURODISCUS (DC. ex Fr.) Pat.: 6, pp. 28, 468.
- dregeana, Hymenochaete (Berk.) Massee: 6, pp. 57, 344; 7, p. 155, 159.  
= *Irpex dregeanus*.
- dregeana, Lopharia (Berk.) Talbot: 6, pp. 57, 344.  
= *Irpex dregeanus*.
- dregeanum, Corticium Berk.: 6, pp. 19, 57, 344.  
= *Irpex dregeanus*.
- DREGEANUS, IRPEX (Berk.) Talbot: 6, p. 344; 7, p. 159.
- DURBANENSE, STEREUM van der Byl: 6, p. 312.
- DURIUSCULA, ASTEROSTROMELLA (B. & Br.) Talbot: 6, p. 51.  
[Syn. *Scytinostroma duriusculum* (B. & Br.) Donk: 7, p. 160.].
- duriusculum, Stereum Berk. & Br.: 6, pp. 45, 51, 313.  
= *Asterostromella duriuscula* (B. & Br.) Talbot.
- DUTHIEAE, DENDROTHELE Talbot: 6, p. 478.
- ELEGANS, CYMATODERMA Jungh.: 7, p. 120.
- elegans, Stereum Mey.: 6, pp. 45, 313.  
Some material is *Stereum thozetii*, other is *Stereum nitidulum*.
- eylesii, Hypocnys van der Byl: 6, p. 63; 7, pp. 146, 155.  
Isotype is *Corticium punctulatum*.
- eylesii, Tomentella (v. d. Byl): 6, p. 63; 7, pp. 155.  
Isotype is *Corticium punctulatum*.
- FARINACEA, CYPHELLA Kalchbr. & Cooke: 6, p. 472.
- fasciatum, Stereum (Schw.) Fr.: 6, p. 314.  
Doubtful. Most specimens appear to be *Stereum lobatum*  
(= *Stereum ostrea* fide Lentz: 7, p. 160.).

- FASCICULATA, HYMENOGHAETE Talbot: 4, p. 943; 6, p. 48.
- FILAMENTOSA, PELLICULARIA (Pat.) Rogers: 7, p. 136.  
[Syn. *Thanatephorus cucumeris* (Frank) Donk.: 7, p. 134.]
- FILAMENTOSA, PENIOPHORA (B. & C.) Burt.: 6, p. 23.
- FLOCCULENTA, CYTIDIA (Fr.) Höhnelt & Litsch.: 6, p. 476.
- FODINARUM, CONIOPHORA Talbot: 6, pp. 34, 36, 64.
- FODINARUM, PELLICULARIA Talbot & Green: 7, p. 135.
- friesii, Cyphella Quel.: 6, pp. 473, 476.  
Material too poor for determination.
- friesii, Stereum Lév.: 6, p. 314.  
Doubtful. Van der Byl's material under *Stereum bellum* is the same species.
- fulva, Hymenochaete Burt.: 7, p. 155.  
No specimens correspond with this.
- fulva, Thelephora Lév.: 6, p. 315; 7, p. 124.  
= *Stereum fulvum*.
- fulvodisca, Cyphella Cooke & Massee: 6, p. 473.  
= *Cyphella variolosa*.
- FULVUM, STEREUM (Lév.) Saccardo: 6, p. 315.
- FUNALIS, CLADODERRIS P. Henn.: 7, p. 122.  
Accepted as to species but closer to *Clavulina* or *Aphelaria* than to *Cladoderris*.
- fuscoviolascens, Hymenochaete (Mont.) v. d. Byl.: 6, p. 50; 7, p. 155.  
No specimens in existence.
- fuscoviolascens, Thelephora Mont.: 6, p. 62; 7, p. 155.  
= *Hymenochaete fuscoviolascens*.
- fuscum, Stereum (Schrad.) Quel.: 6, pp. 39, 40, 45, 316.  
= *Stereum bicolor*.
- GELATINOSUS, MERULIUS Lloyd: 6, p. 32.
- GIGANTEA, PENIOPHORA (Fr.) Massee: 6, p. 24.
- glabrescens, Stereum Berk. & Curt.: 6, p. 316.  
Material is *Stereum affine*.
- glebulosa, Peniophora (Bres.) Sacc. & Syd.: 6, p. 25; 7, p. 148.  
= *Peniophora gracillima*.
- GLOEOSPORUM, CORTICIUM Talbot: 4, p. 940; 6, p. 14.
- GRACILLIMA, PENIOPHORA Ell. & Everh.: 7, p. 147.
- HABGALLAE, CYTIDIA (B. & Br.) Martin: 6, p. 477.
- HIMANTIOIDES, MERULIUS Fr.: 6, p. 31.
- hirsuta, Thelephora (Willd.) Pers. ex Fr.: 7, p. 124.  
= *Stereum hirsutum*.
- HIRSUTUM, STEREUM (Willd.) Pers. ex S. F. Gray: 6, p. 316.
- hirsutum forma kalchbrenneri, Stereum Simpson & Talbot: 6, p. 317.  
*nomen nudum*; = *Stereum hirsutum*.
- INCANUM, POROTHELEUM (Kalchbr.) Sacc.: 6, p. 479.
- incanum, Stigmatolemma Kalchbr.: 6, p. 481.  
= *Porotheleum incanum*.
- incarnata, Peniophora (Pers. ex Fr.) Karst.: 7, p. 148.  
Specimen is close to *P. incarnata* but lacks gloecystidia and may be undescribed.
- INCRUSTATA, CONIOPHORA Talbot: 7, p. 139.
- infundibuliformis, Cladoderris (Klotzsch) Fr.: 7, p. 123.  
= *Cymatoderma elegans*.
- intybacea, Thelephora Pers. ex Fr.: 7, p. 124.  
Specimens accepted as *Thelephora terrestris*.
- INVOLUTUM, STEREUM (Klotzsch) Fr.: 6, p. 317; 7, p. 118.
- kalchbrenneri, Stereum Sacc.: 6, p. 319.  
= *Stereum hirsutum*.
- laciinata, Thelephora Pers. ex Fr.: 7, p. 124.  
= *Thelephora terrestris*.

lacrymans, *Merulius* (Wulf. ex Fr.) Fr.: 6, pp. 32, 33; 7, p. 152.

Doubtful. Usually confused with *Merulius himantioides*.

lacteam, *Corticium* Fr.: 6, p. 19; 7, p. 143.

*nomen dubium*; No specimens seen.

laetum, *Corticium* (Karst.) Pers.: 7, p. 144.

Specimens are *Corticium salmonicolor*.

laxum, *Stereum* Lloyd: 6, pp. 45, 319.

= *Stereum bicolor*.

lirellosa, *Lopharia* Kalchbr. & MacOwan: 6, pp. 309, 340.

= *Stereum cinerascens*.

LOBATUM, STEREUM (Kze. ex Fr.) Fr.: 6, p. 319.

(Syn. *Stereum ostrea* fide Lentz: 7, p. 160.).

lobatum var cinereum, *Stereum* Lloyd ex Doidge: 6, p. 320.

*nomen nudum*; = *Stereum australe*.

LONGISPORA (Pat.) Höhn. var BRACHYSPORA Talbot & Green, PENIOPHORA: 7, p. 148.

LUTEOBADIA, HYMENOGHAETE (Fr.) Höhn. & Litsch.: 6, p. 50; 7, p. 155.

luteobadium, *Stereum* Fr.: 6, pp. 45, 320, 323; 7, p. 155.

= *Hymenochaete luteobadia*. But some specimens seen are *Stereum lobatum*.

LUTEOCYSTIDIATUM, CORTICIUM Talbot: 4, p. 941; 6, p. 13.

membranaceum, *Stereum* Fr.: 6, pp. 45, 320.

Material is *Stereum fulvum*.

MINIMA, SOLENIA Cooke & Phil.: 6, p. 480.

MIRABILIS, ALEURODISCUS (B. & C.) Höhn. & Litsch.: 6, p. 469.

mirabilis, *Lopharia* (B. & Br.) Pat.: 6, pp. 56, 340.

= *Stereum cinerascens*.

MOLLUSCUS, MERULIUS Fr.: 7, p. 153.

MONILIFORME, CORTICIUM Talbot: 7, p. 144.

MURRAI, STEREUM (Berk. & Curt.) Burt: 6, p. 320.

murrayi, *Stereum* (B. & C.) Burt: 6, p. 320.

Orthographic variant of *Stereum murrayi*.

MUSCICOLA, SISTOTREMA (Pers.) Lundell: 7, p. 158.

natalensis, *Femsjonia* Cooke: 6, p. 476.

A species of *Cyphella*, but the material is in poor condition.

NATALENSIS, SOLENIA W. B. Cooke: 6, p. 480.

NIGRICANS, HYMENOGHAETE (Lév.) Bres.: 7, p. 156.

nigricans, *Stereum* Lév.: 7, p. 156.

= *Hymenochaete nigricans*.

NITIDULUM, STEREUM Berk.: 6, p. 321.

notatum, *Stereum* B. & Br.: 6, p. 322.

Dubious. South African material is probably a young *Stereum hirsutum*.

nuda, *Peniophora* (Fr.) Bres.: 6, p. 25; 7, p. 149.

Doubtful. No specimens traced.

nudum, *Corticium* Fr.: 6, p. 19.

= *Peniophora nuda*.

ochraceoflavum, *Stereum* Schw. ex Peck: 6, p. 322.

Specimen is not this species but its true identity is doubtful.

OCHROMARGINATA, HYMENOGHAETE Talbot: 4, p. 944; 6, p. 49.

OLIVACEA, CONIOPHORA (Fr.) Karst.: 6, p. 35.

olivacea, *Coniophorella* (Fr.) Karst.: 6, p. 35.

= *Coniophora olivacea*.

OSTREA, STEREUM (Blume & Nees) Fr.: 6, p. 322; 7, p. 160.

No specimens available under this name.

PALLIDUM, CORTICIUM Bres.: 6, p. 13.

palmata, *Thelephora* (Scop.) Fr.: 7, p. 124.

Material indeterminable but certainly not *T. palmata*.

PAPILLOSA, CONIOPHORA Talbot: 4, p. 939; 6, p. 33.



papyrina, *Peniophora* (Mont.) Cooke: 7, p. 149.

Doubtful. One specimen is *Stereum fulvum*; one other specimen not seen.

pedicellata, *Thelephora* Schw.: 6, p. 63; 7, p. 125.

The material is a species of *Septobasidium* but not *S. schweinitzii* with which *T. pedicellata* is synonymous.

PELARGONII, *CYPHELLA* Kalchbr.: 6, p. 473.

pellicula, *Hymenochaete* B. & Br.: 6, p. 329.

MacOwan (1055) in Herb. S.A. Mus. No. 34315 is *Stereum umbrinum*.

pelliculare, *Corticium* Karst.: 6, p. 19; 7, p. 145.

The material is *Peniophora arenata*.

PELLICULOSA, *PENIOPHORA* Talbot: 6, pp. 20, 63.

penicillata, *Thelephora* Lloyd: 7, p. 125.

Invalid as a later homonym of *T. penicillata* Fr. The specimens are possibly *Thelephora mollissima*.

percome, *Stereum* B. & Br. 6, pp. 45, 322.

The material is *Hymenochaete nigricans*.

perlatum, *Stereum* Berk.: 6, p. 322.

The material is *Stereum lobatum* (= *S. ostrea* fide Lentz: 7, p. 160).

pinastri, *Merulius* (Fr.) Burt: 7, p. 154.

Specimen deformed and indeterminable but does not correspond microscopically with *M. pinastri*.

POLYGONIOIDES, *ALEURODISCUS* (Karst.) Pilat: 6, p. 470.

[Syn. *Laeticorticium polygonioides* (Karst.) Donk.: 7, p. 160.]

POROSUM, *CORTICIUM* Berk. & Curt.: 7, p. 145.

portentosum, *Corticium* Berk. & Curt.: 6, pp. 19, 52.

South African material is *Asterostromella duriuscula*.

praetermissum, *Corticium* Karst.

= *Peniophora tenuis*.

proximum, *Stereum* Lloyd: 6, p. 322.

= *Stereum involutum*.

pruinata, *Peniophora* (B. & C.) Burt: 7, p. 150.

= *Stereum pruinatum*; but the South African material is different and indeterminable.

pruinatum, *Stereum* B. & C.: 6, pp. 45, 322; 7, p. 150.

Indeterminable material but not this species.

PRUINOSA, *PENIOPHORA* (Pat.) Jackson: 7, p. 150.

pulverulenta, *Coniophora* (Lév.) Massee: 7, pp. 126, 139.

= *Thelephora pulverulenta* Lév., whose type is a species of *Hymenochaete*, probably *H. luteobadia*.

pulverulentum, *Stereum* Lév.: 6, p. 323; 7, p. 139.

The type specimen is a species of *Hymenochaete*, probably *H. luteobadia*.

punctiformis, *Cypbella* (Fr.) Karst.: 6, p. 474.

One specimen is a minute agaric. There is no material of the other which was recorded as *C. punctiformis* var *strigosa*.

punctiformis (Fr.) Karst. var *strigosa* Kalchbr. & Cooke, *Cypbella*: 6, p. 474. Not accepted as a good variety; no specimen available.

PUNCTULATUM, *CORTICIUM* Cooke: 7, pp. 146.

punicea, *Thelephora* Alb. & Schw. ex Fr.: 6, p. 63; 7, pp. 126, 154.

= *Tomentella punicea*, but no South African collections in existence.

puniceus, *Hypochnus* (Alb. & Schw. ex Fr.) Sacc.: 6, p. 63; 7, p. 154.

= *Tomentella punicea*.

punicea, *Tomentella* (Alb. & Schw. ex Fr.) Schroet.: 6, p. 63; 7, p. 154.

No South African collections in existence.

PURPUREUM, *STEREUM* (Pers. ex Fr.) Fr.: 6, p. 323.

pusillum, *Stereum* Berk.: 6, p. 324.

Some of the material is *Stereum thozetii*, other is *Stereum diaphanum*.

puteana, *Coniophora* (Schum. ex Fr.) Karst.: 6, pp. 34, 36; 7, p. 140.

Most records are *Coniophora fodinarum*, others are indeterminable. None of *C. puteana* yet seen in South Africa.

radicans, Stereum (Berk.) Burt: 6, p. 324.

Poor specimen but very doubtful if it matches *Stereum radicans*.

RAVENELII, STEREUM Berk. & Curt.: 6, p. 325.

retiruga, Lloydella (Cooke) Bres.: 6, p. 43.

= *Stereum fulvum*.

retirugum, Stereum Cooke: 6, p. 325.

= *Stereum fulvum*.

RHOINA, SOLENIA W. B. Cooke: 6, p. 481.

RIMICOLA, PENIOPHORA (Karst.) Höhnelt & Litsch.: 7, p. 151.

rimosum, Stereum Berk.: 6, pp. 45, 325.

Material is referred to *Stereum rimosum* var *africanum*.

RIMOSUM Berk. var AFRICANUM Talbot, STEREUM: 4, p. 945; 6, pp. 38, 325.

ROSEUS, ALEURODISCUS (Pers. ex Fr.) Höhnelt & Litsch.: 6, p. 470.

[Syn. *Laeticorticium roseum* (Pers. ex Fr.) Donk: 7, p. 160].

ROUMEGUIERII, PENIOPHORA Bres.: 6, p. 22.

rubiginosa, Hymenochaete (Dicks. ex Fr.) Lev.: 6, p. 50; 7, p. 156.

Original specimen not seen; rest of South African specimens referred to *Hymenochaete ochromarginata*.

rubiginosum, Stereum Dicks. ex Fr.: 6, pp. 45, 326; 7, p. 156.

= *Hymenochaete rubiginosa*.

rufus, Merulius Pers. ex Fr.: 7, p. 154.

Material is *Merulius corium*.

rugosum, Stereum (Pers.) Fr.: 6, p. 326.

Material is mostly *Stereum rimosum* var *africanum*. Some specimens are *Stereum durbanense*.

RUMPIANA, ASTEROSTROMELLA Talbot: 4, p. 939; 6, pp. 53, 54.

(Associated in genus *Scyriostroma* by Donk: 7, p. 160.).

SALMONICOLOR, CORTICIUM B. & Br.: 6, p. 17.

SANGUINOLENTUM, STEREUM (Alb. & Schw. ex Fr.) Fr.: 6, pp. 37, 326.

schomburgkii, Stereum Berk.: 6, pp. 43, 327.

= *Stereum fulvum*.

SCUTELLARE, CORTICIUM B. & C.: 6, p. 16.

SEMISTUPPOSA, HYMENOGHAETE Petch: 6, p. 49.

serpens, Merulius Tode ex Fr.: 6, p. 33; 7, p. 154.

No material seen; Doubtful.

setigera, Peniophora (Fr.) Bres. ex Bourd. & Galz.: 6, p. 21.

= *Peniophora aspera*.

SIMULANS, CYTIDIA Lloyd: 6, p. 478.

sinuans, Thelephora Pers.: 7, p. 126.

No specimens available. Said by Lentz to be a synonym of *Stereum frustulatum*.

solani, Corticium (Prill. & Delacr.) Bourd. & Galz.: 7, pp. 136, 146.

= *Pellicularia filamentosa*.

spadiceum, Stereum Fr.: 6, p. 327.

Some material is *Stereum australe* and some *Stereum hirsutum*.

spongiosa, Cladoderris Fr.: 7, p. 120.

= *Cymatoderma elegans*.

spongiosa Fr. var subsessilis Fr., Cladoderris: 7, p. 121.

= *Cymatoderma elegans*.

squalidus, Merulius Fr.: 6, pp. 31-33.

= *Merulius himantioides*.

strigoso-zonata, Phlebia (Schw.) Lloyd: 6, p. 28.

= *Punctularia strigoso-zonata*.

STRIGOSO-ZONATA, PUNCTULARIA (Schw.) Talbot: 7, p. 143.

subpileatum, Stereum Berk.: 6, p. 327.

Material is *Stereum durbanense*.

tabacina, Cyphella Cooke & Phill.: 6, p. 474.

= *Cyphella variolosa*.

- tabacina, Hymenochaete (Sow. ex Fr.) Lév.: 6, p. 327; 7, p. 157.  
One specimen not located. The others are *Stereum umbrinum* and a species of *Hymenochaete* which is not *H. tabacina*.
- tabacina (Sow. ex Fr.) Lév. var. *australis* Mont., Hymenochaete: 6, p. 327; 7, p. 157.  
= *Hymenochaete tabacina*.
- tabacinum Sow. ex Fr. var. *australis* Mont., Stereum: 6, p. 327.  
= *Hymenochaete tabacina*.
- tenebrosum, Stereum Lloyd: 6, p. 327.  
= *Stereum australe*.
- TENUIS, PENIOPHORA (Pat.) Massee: 7, p. 151.
- tenuissima, Hymenochaete Berk.: 6, p. 50; 7, p. 151.  
One specimen is *Polystictus tabacinus*; the other has not been located.
- TERRESTRIS, THELEPHORA Erhart ex Fr., 7, p. 126.
- THOZETII, STEREUM Berk.: 6, p. 327.
- thwaitesii, Cladoderris B. & Br.: 7, pp. 122, 123.  
South African material included a species of *Favolus* and *Cymatoderma elegans*. True *Cladoderris thwaitesii* is a bleeding species of *Stereum*.
- tomentosum, Stereum van der Byl: 6, p. 328.  
= *Stereum durbanense*.
- transvaalium, Stereum van der Byl: 6, p. 328.  
To be taken either as a *nomen confusum* or as a synonym of *Stereum australe*.
- tremellosus, Merulius Schrad. ex Fr.: 7, p. 154.  
The specimen is *Merulius corium*.
- TRISTICULA, DUPORTELLA (B. & Br.) Reinking: 6, pp. 45-48.
- tristricula, Hymenochaete B. & Br.: 6, p. 50; 7, p. 157.  
= *Duportella tristricula*.
- TUBERCULOSA, PUNCTULARIA (Pat.) Pat.: 6, p. 25; 7, p. 140.
- TUMULOSUM, CORTICIUM Talbot: 4, p. 941; 6, p. 17.
- turgidum, Stereum Lloyd: 6, pp. 328, 340.  
= *Stereum cinerascens*.
- UMBRINUM, STEREUM Berk. & Curt.: 6, pp. 41, 329.  
[Syn. *Laxitextum crassum* (Lév.) Lentz: 7, p. 160. *Lopharia vinosa* (Berk.) G. H. Cunn.: 7, p. 160.]
- umbrinus, Merulius Fr.: 6, pp. 31, 33.  
= *Merulius himantoides*.
- VAGA, PELLICULARIA (B. & C.) Rogers ex Linder: 7, pp. 135, 146.
- vagum, Corticium B. & C.: 6, p. 19; 7, pp. 135, 146.  
= *Pellicularia vaga*.
- vagum, Corticium sensu Burt: 7, pp. 135, 136.  
= *Pellicularia filamentosa*.
- vagum var. *solani*, Corticium Burt ex Rolfs: 7, pp. 136, 146.  
= *Pellicularia filamentosa*.
- VARIOLOSA, CYPHELLA Kalchbr.: 6, p. 474.
- vellereum, Stereum Berk.: 6, p. 329.  
Probably only a form of *Stereum hirsutum*.
- vellereus, Irpex B. & Br.: 6, p. 324.  
= *Irpex dregeanus* (Reid differentiates *I. vellereus* and *I. dregeanus*: 7, p. 159.).
- velutina, Peniophora (DC. ex Fr.) Cooke: 7, p. 152.  
The specimen is *Peniophora roumeguerii*.
- versicolor, Stereum (Swartz ex Fr.) Fr.: 6, p. 330.  
Dubious. The specimens seen are not *Stereum versicolor*. One of them is *Stereum lobatum*.
- villosum, Stereum Lev.: 6, p. 330.  
= *Hymenochaete nigricans*.
- vitile, Stereum Fr.: 6, p. 330.  
No specimen in existence. From the description not unlike *Stereum umbrinum*.
- vorticosum, Stereum Fr.: 6, p. 330.  
= *Stereum purpureum*.

## EXPLANATION OF THE ILLUSTRATIONS.

The following lettering has been used throughout the illustrations:—

B	= Basidia.	G	= Gloecystidia.
BB	= Bulbils.	H	= Hyphae.
C	= Cystidia.	HA	= Habit.
CO	= Conidia.	S	= Basidiospores.
CP	= Conidiophores.	SE	= Setae.
CY	= Cystidioles.		= Surface hairs.
D	= Dendrophyses.		



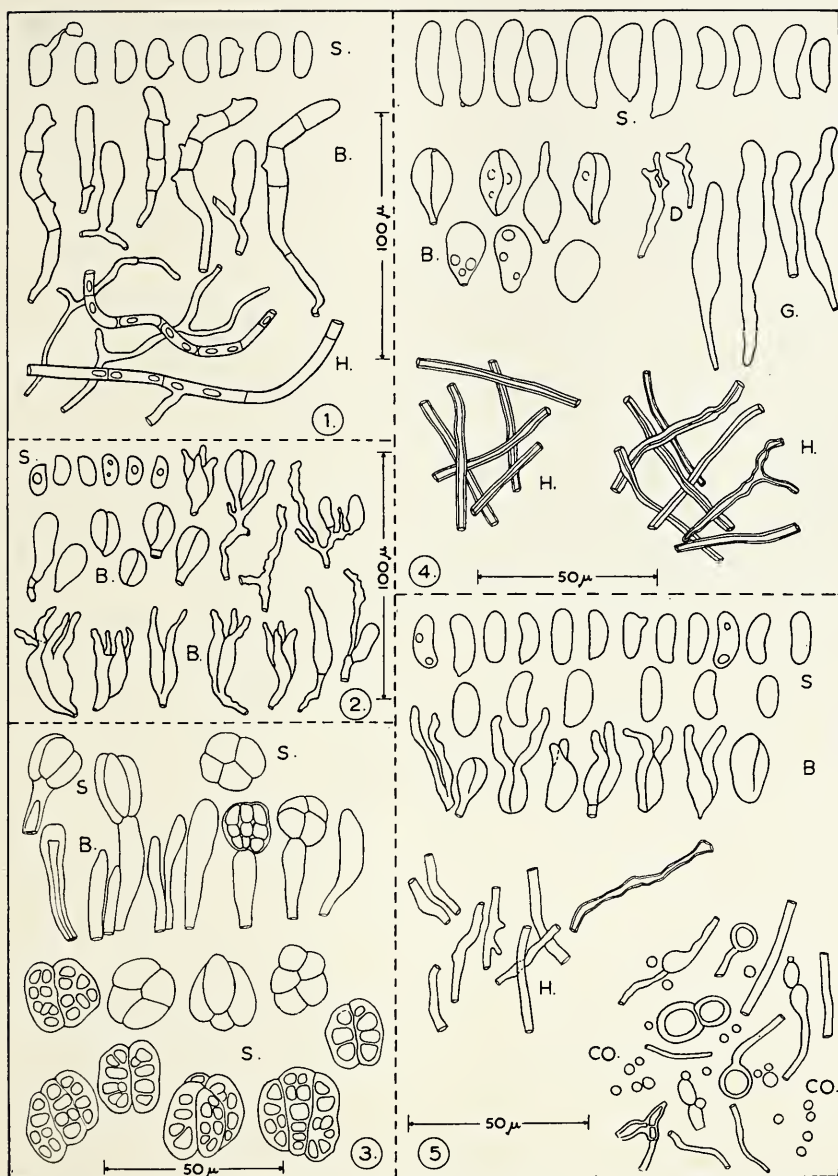


FIG 1.—*Platyglaea opalina*. FIG. 2.—*Eichleriella macrospora*. FIG. 3.—*Coniodictyum chevalieri*. FIG. 4.—*Heterochaete grandispora*. FIG. 5.—*Heterochaete byliana*.

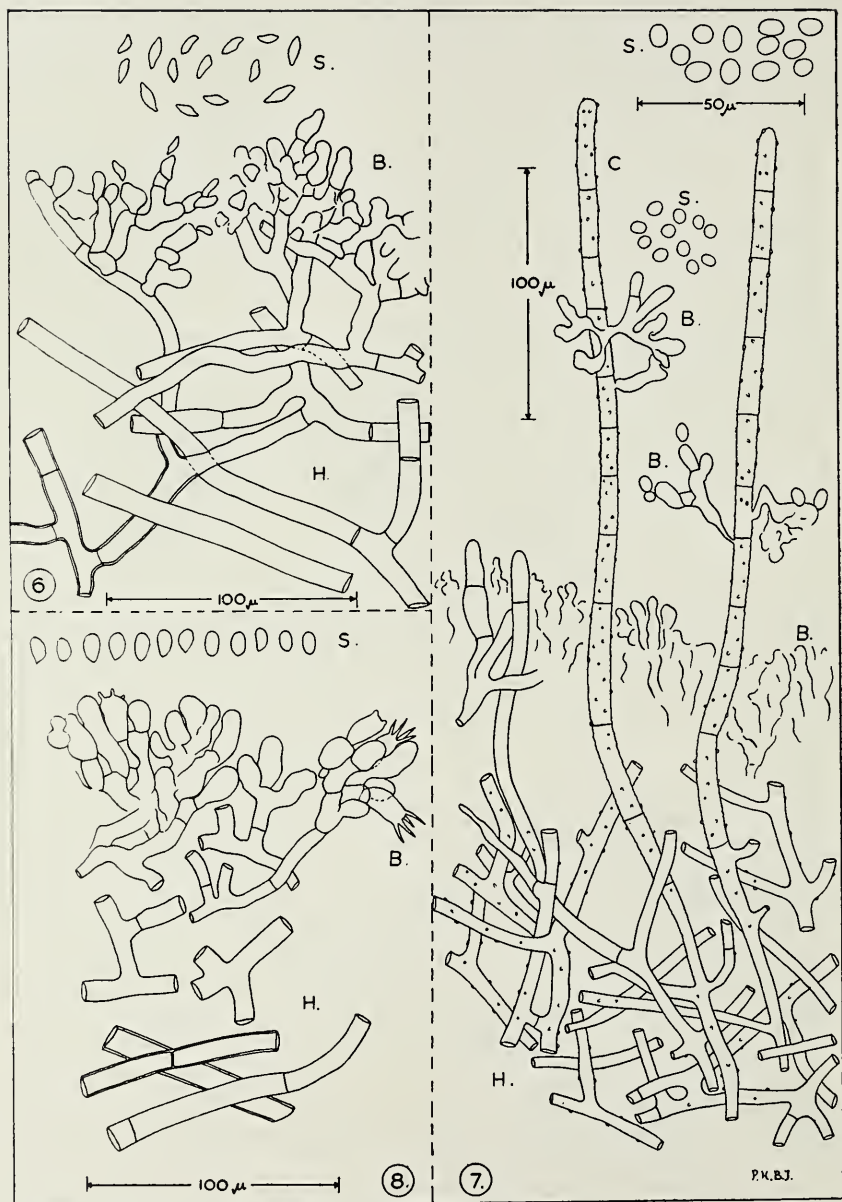


FIG. 6.—*Pellicularia vaga*. FIG. 7.—*Pellicularia fodinarum*. FIG. 8.—*Pellicularia filamentosa*.

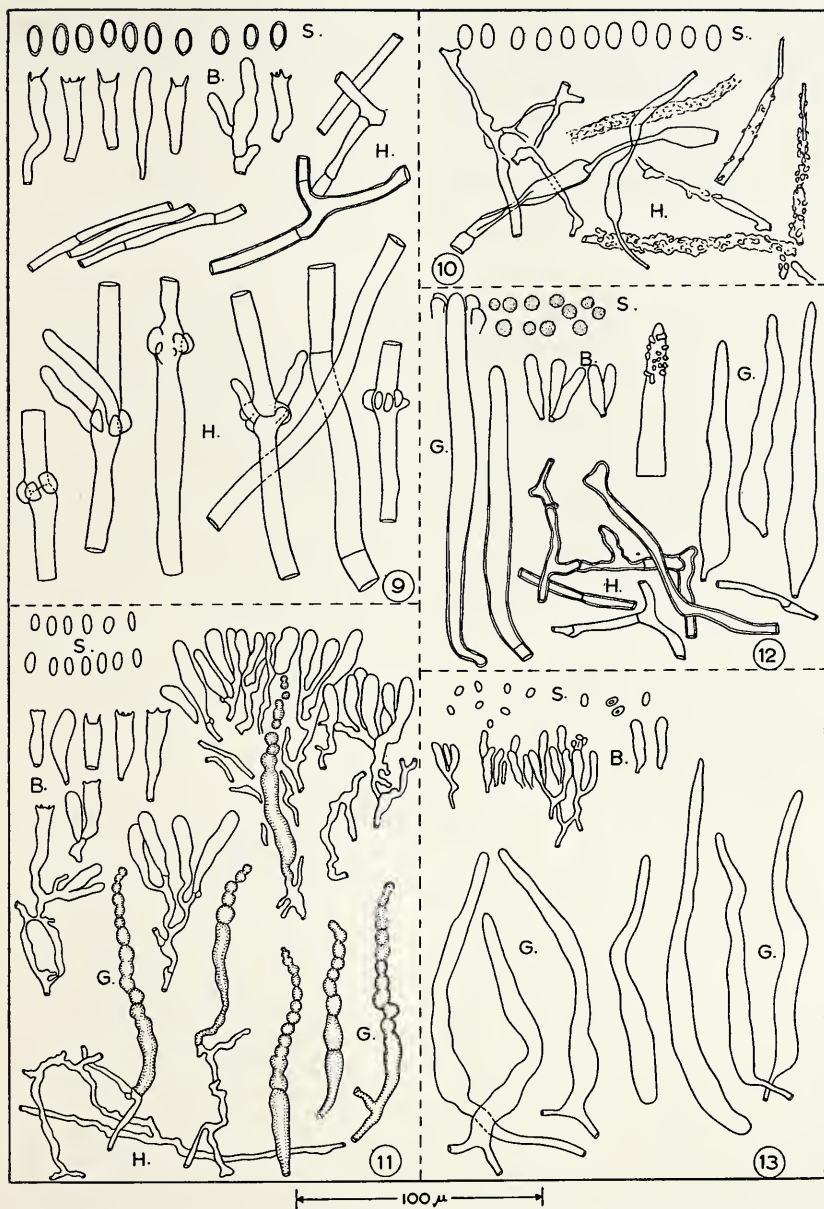


FIG. 9.—*Coniophora arida*. FIG. 10.—*Coniophora incrustata*. FIG. 11.—*Corticium moniliforme*. FIG. 12.—*Corticium punctulatum*. FIG. 13.—*Corticium porosum*.

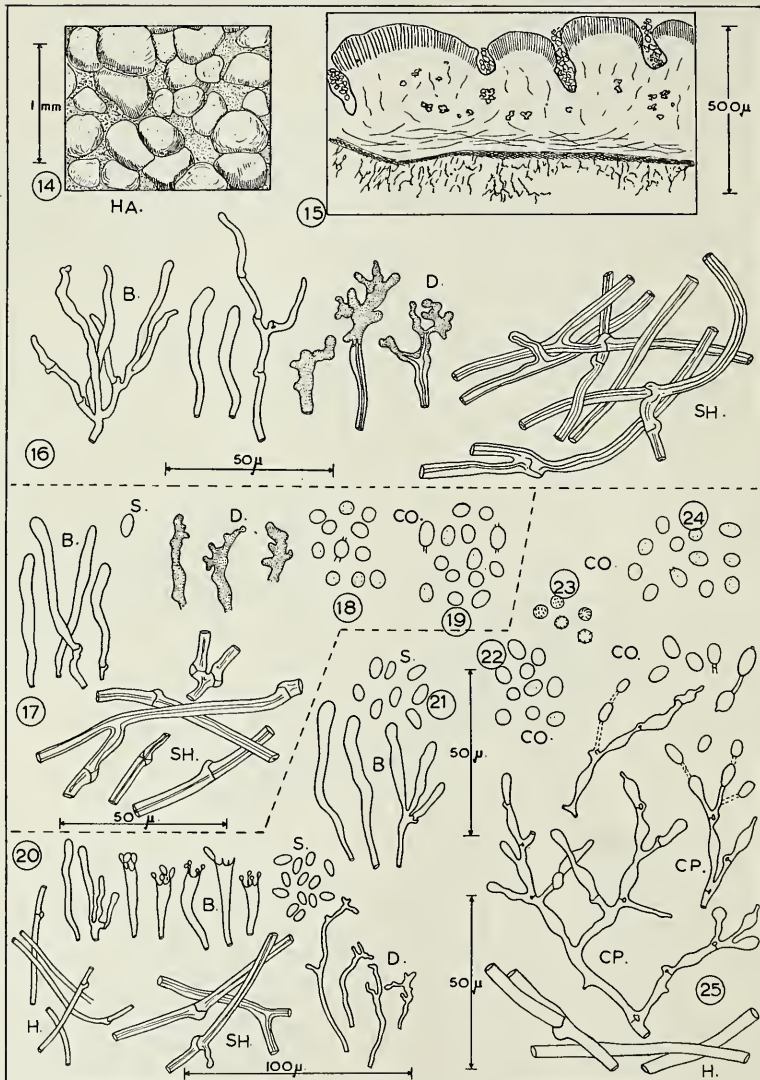


FIG. 14.—*Punctularia tuberculosa*, Type, hymenial surface. FIGS. 15, 16.—*Punctularia tuberculosa*, Type. FIG. 17.—*Corticium conigenum*, Type, basidia. FIG. 18.—*C. conigenum*, Type, conidia from bark. FIG. 19.—*C. conigenum* Type, conidia from culture. FIGS. 20–25.—*Punctularia tuberculosa* (No. 40510). FIG. 22.—Conidia from young culture. FIG. 23.—Conidia from old dried culture. FIG. 24.—Conidia from bark. FIG. 25.—Conidia and conidiophores in slide culture.



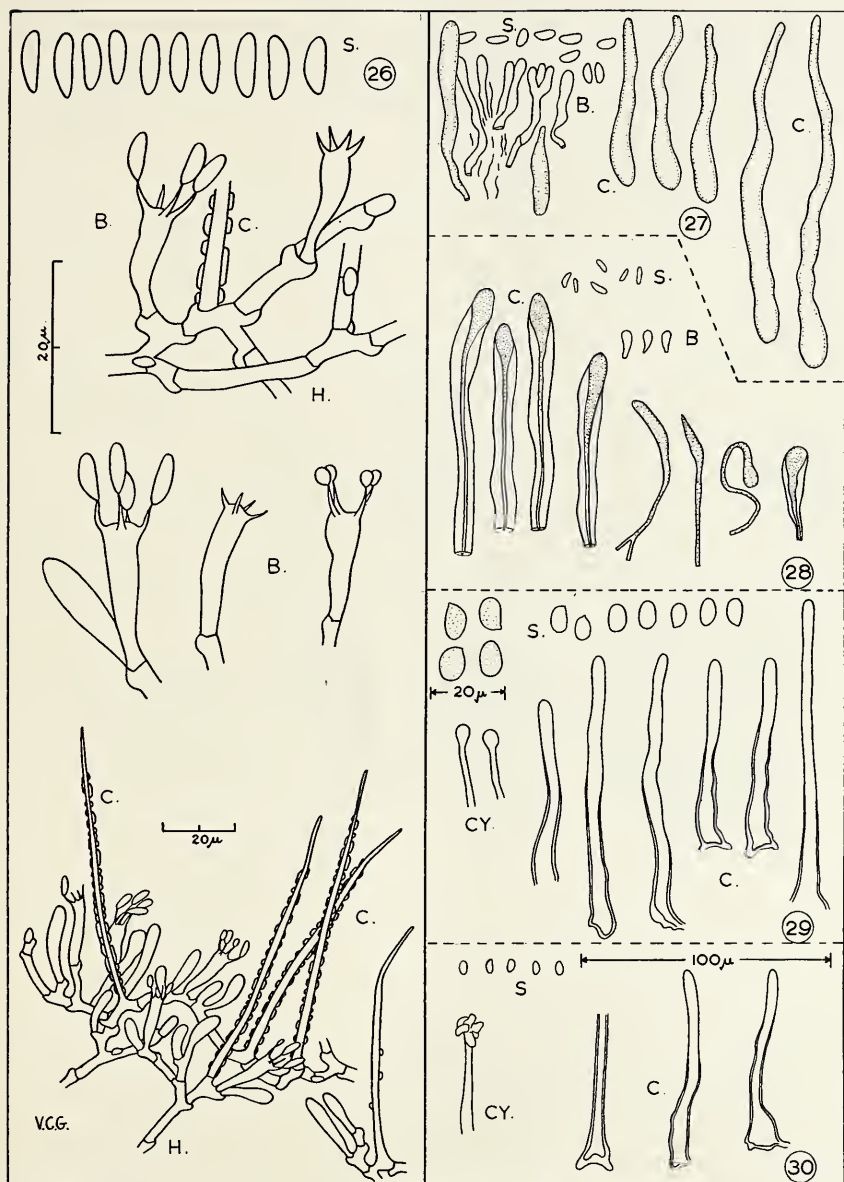


FIG. 26.—*Peniophora longispora* var *brachyspora*, Type. FIG. 27.—*Peniophora tenuis*.  
 FIG. 28.—*Peniophora gracillima*. FIG. 29.—*Peniophora rimicola*. FIG. 30.—*Peniophora pruinosa*.

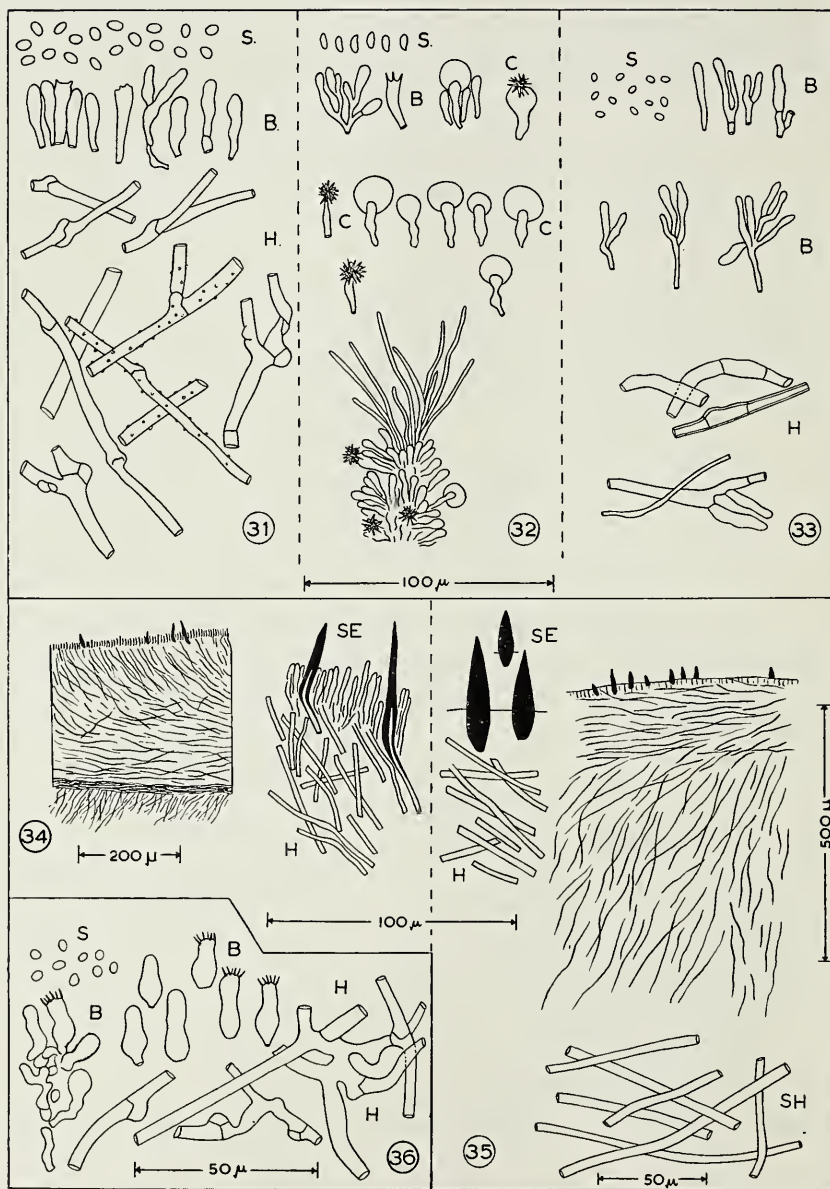


FIG. 31.—*Merulius molluscus*. FIG. 32.—*Odontia bicolor*. FIG. 33.—*Grandinia rosea*.  
 FIG. 34.—*Hymenochaete luteobadia*. FIG. 35.—*Hymenochaete nigricans*. FIG.  
 36.—*Sistotrema muscicola*.

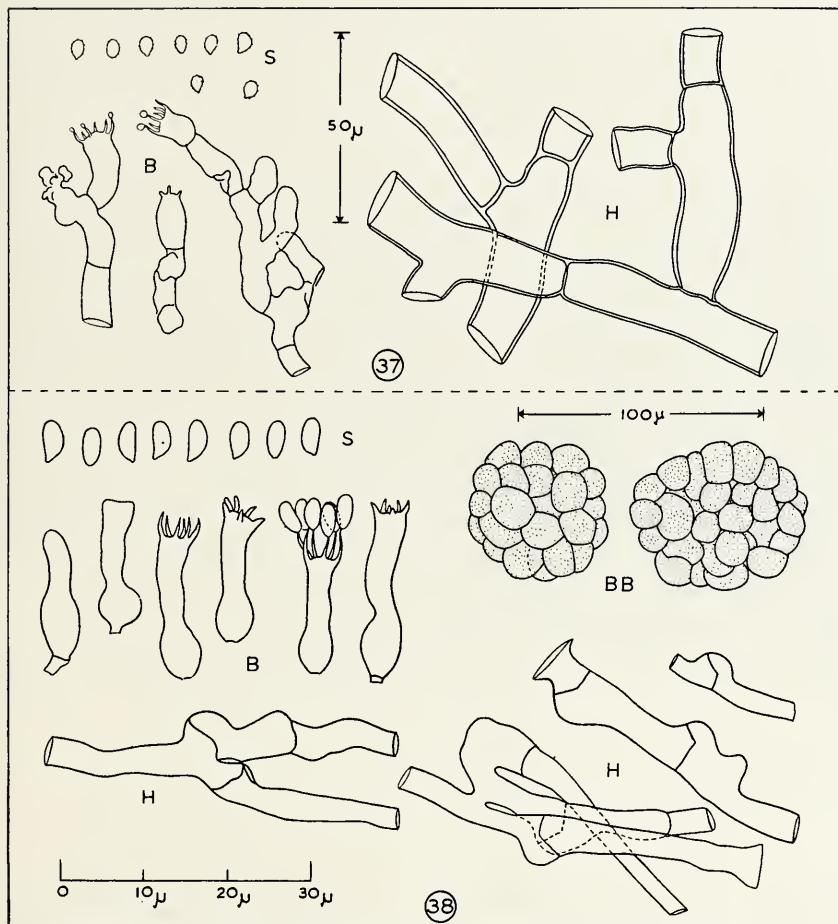


FIG. 37.—*Pellicularia asperula*. FIG. 38.—*Sistotrema brinkmanni*.





## Notes on some Species of *Cladophora* from South Africa.

By

R. H. Simons.

Several species of *Cladophora* have been collected during an investigation of Cape seaweeds and most have been readily identified by comparison with named specimens in the Stephenson and Tyson collections of South African seaweeds at the University of Cape Town. Most of Stephenson's material was identified by himself, but it includes some specimens named by overseas authorities. The type specimens of certain species that have particularly interested me are in the Agardh Herbarium in Lund and are not available on loan, which has meant falling back largely on literature for checking identifications. In general, the determination of *Cladophoras* by these methods has given little difficulty. But there is confusion in the application of the names *C. flagelliformis*, *C. capensis* and *C. virgata*, and the present paper attempts to resolve the difficulty.

The Tyson specimens under these three names were determined by G. F. Papenfuss in 1939, whereas the Stephenson material was apparently named when collected about 1937. It was obvious that most of Stephenson's specimens of *C. flagelliformis* and *C. virgata* did not correspond respectively in morphology with specimens so named by Papenfuss in the Tyson collection. The following paragraph was found in a paper by Stephenson (1944) and accounts for this discrepancy: "There are two common species of *Cladophora*, quite distinct in appearance, which bear these names [*C. flagelliformis* and *C. virgata*]. One of them is a long, coarse, blue-green species, the other a shorter, silkier, bright green form. The former has hitherto been known as *flagelliformis*, the latter as *virgata*. It now proves that the two names should be interchanged, so that the coarse plant becomes *virgata*, the other *flagelliformis*". Once the suggested interchange of names had been made in Stephenson's material the discrepancy between this and Papenfuss's (Tyson collection) was removed.

This should have resolved any further difficulty in identifying specimens of these two species, but instead I found that according to the original literature *C. flagelliformis* and *C. virgata* are closely similar, whereas in the material at hand there was a likeness between plants named *C. flagelliformis* and some of those named *C. capensis*, but a dissimilarity between those named *C. flagelliformis* and *C. virgata*.

On comparing the literature on *C. flagelliformis*, it was found that the plants so named in the Stephenson and Tyson collections disagreed in several respects with the original description but agreed with the description given by Levring (1938), thus suggesting that Levring, Papenfuss and Stephenson (after his correction) had misapplied the name.

Stephenson stated that *C. flagelliformis* and *C. virgata* are "quite distinct in their appearance". This is contrary to the views of Kützing (1843), who transferred these species to *Cladophora*, and of de Toni (1889, p. 331). Kützing related the two species closely but stated that *C. flagelliformis* is longer and more slender than *C. virgata* and de Toni added that they are "scarcely distinct". Areschoug (1851) goes further and says they are synonymous. Moreover, Kützing and Stephenson disagree as to which is the longer species, for Stephenson stated that this is *C. virgata*.

If a general comparison of Kützing's description of *C. flagelliformis* is made with Stephenson's material under the name *C. virgata* a conformity is immediately apparent. Both have shorter and more slender branches in the lower parts and longer flagelliform branches above. The dilation of all branches towards their apices is characteristic of both, and cell proportions in comparable parts are essentially the same. The apical cells in both are obtuse. de Toni (1889) gives the length of *C. flagelliformis* as 18–20 cm; plants of Stephenson's *C. virgata* are up to 17 cm long. Several specimens of comparable material collected by me are more than 20 cm. in height, whereas *C. flagelliformis* sensu Levring has a maximum height of 15 cm. The similarity of *C. virgata* sensu Stephenson to the true *C. flagelliformis* (Suhr) Kütz. therefore seems obvious. If Suhr's (1840) original description of *flagelliformis* is also considered, one sees its applicability to Kützing's figure (Kützing, 1853) of *C. virgata* (Ag.) Kütz. One is thus led to the hypothesis that Kützing's *C. flagelliformis* is merely a longer form of his *C. virgata*.

My observations of *Cladophora* plants in which all the branches dilate upwards, show that there are stunted forms and elongated ones which I am unable to distinguish on morphological grounds as distinct species. The stunted forms in my opinion are typical of *C. virgata* (Ag.) Kütz., and the elongated forms could be referred to *C. flagelliformis* (Suhr) Kütz. Apart from Levring's account of *C. flagelliformis* I can find nothing in the earlier descriptions to show any inherent difference between *C. virgata* and *C. flagelliformis* except one of relative size, and Kützing's implication of an associated distinction in branching. My observations are that the branching habits of smaller and larger plants show no consistent difference such as that suggested by Kützing.

Stephenson's material named *C. flagelliformis* on the basis of Levring's description diverges too far from earlier descriptions to be accepted as this species; but in my opinion it is clearly related to *Cladophora capensis* (Ag.) Kütz. and the two appear to me to be included in the range of variation of one species.

The conclusion reached is that *C. flagelliformis* (Suhr) Kütz. is a synonym of *C. virgata* (Ag.) Kütz., the latter being the prior name by which the species should be known. *C. flagelliformis* sensu Levring is I suggest a synonym of *C. capensis* (Ag.) Kütz.\* A third species *C. isaacii*, identified by an earlier investigator as *C. capensis*, is distinguished.

Descriptions are appended of the three species that have been recognised.

(1) *Cladophora virgata* (Ag.) Kütz., Sp. Alg. p. 388, 1843.

*Conferva virgata* Ag., Syst. Alg. p. 119, 1824.

*Cladophora flagelliformis* (Suhr) Kütz., Sp. Alg. p. 388, 1843.

*Holdfast* A rather small knob-like structure which is somewhat flattened at its base to form a disc up to 3 mm in diameter. The whole is formed from the compacting of the main filaments at their bases and is surrounded by a hyaline sheath which is continuous with the walls of the filaments (Fig. 1a). The compact holdfast is not easily dissected owing to the presence of the sheath. *Erect System*, (i) *Branching*: Several closely compacted filaments arise from the holdfast and these soon diverge to form elongated filaments which produce short branches almost throughout their length. These short branches diverge strongly from the line of the main filaments and are usually naked (Fig. 1b). Elongated branches arise occasionally in the lower parts, but are mostly

\* Dr. Papenfuss has kindly confirmed in a private communication that *C. virgata* (Ag.) Kütz. and *C. flagelliformis* (Suhr) Kütz. are synonymous. He states that the material seen and described by Levring was wrongly circulated by Suhr as examples of *Conferva flagelliformis* Suhr, but is in fact representative of a new species. At the moment I am not convinced that *C. flagelliformis* sensu Levring is a new species.

produced in the upper parts; the upper branches may again branch in a di- or trichotomous manner in which case they are all flagelliform (Pl. 1). Branching throughout the plants is typically opposite but may be alternate or in whorls of three or four. All branches dilate towards their apices. Many of the flagelliform branches become truncate by loss of their terminal portions. Basal cells of branches tend to coalesce slightly at their origins but never appear to arise from the centre of a cell, except perhaps near the holdfast. (ii) *Cells of the Filaments*: Near the holdfast these are clearly defined and are two to four times longer than broad but may occasionally be as much as six times as long as their diameter. In the upper parts all the cells have more or less the same length and breadth (Fig. 1c). The cell contents throughout the plant are dense and opaque, and specimens regarded as comparable in the field are very dark green with a bluish shade. Apical cells of branches have obtuse tips and are usually more or less umbonate (Fig. 2).

(2) *Cladophora capensis* (Ag.) Kütz. Sp. Alg. p. 421, 1849.

*Conferva capensis* Ag., Syst. Alg. p. 118, 1824.

*Cladophora ecklonii* (Rud.) Kütz., Phyc. Gen. p. 270, 1843.

*Conferva ecklonii* Rud., Linnaea 6, p. 180, 1831; Suhr, Flora 17, p. 741, 1834.

*Holdfast*: This is a matted cushion up to 1.5 cm. in diameter and formed of branched rhizoids which usually contain chlorophyll. The plant is easily dissected into main filaments with rhizoids below (Fig. 3). *Erect System*, (i) *Branching*: This ranges from near dichotomy (Fig. 4) to distinct main filaments bearing fascicles of short branches throughout their length (Pl. 2). Generally branching is alternate, but sometimes the branches arise in whorls of two or more. Longer branches characteristically arise in the lower parts of the plants, but they may occur in the upper parts in which case they may become somewhat dilated and frequently dissolute towards their apices (Fig. 5a). Such dilation frequently results in these branches becoming thicker than the main filaments in their lower parts. The ultimate branchings are often dichotomous. Other branches taper gradually towards their apices (Fig. 5b). Basal cells of branches tend more or less markedly to coalesce with cells of parent filaments (Fig. 5c) especially in the lower parts of the plants where basal cells of branches appear to originate from the centre of a cell, (Fig. 5d). All branches tend to be appressed to their parent filaments (Pl. 2). (ii) *Cells of the Filaments*: Cells near the holdfast are four to six times longer than they are broad but may be up to ten times longer. In the upper parts of the plants the cells are two to four times longer than broad but may be almost as broad as they are long in branches which dilate upwards. Apical cells vary somewhat in shape but they are usually two to three times longer than broad and either umbonately acute, especially in dilated branches (Fig. 5e & f), or more or less acuminate (Fig. 6). The hyaline cap terminating branches is always thick and may be as much as eight times thicker than the lateral walls. A feature not always apparent is the presence of inflated cells of a clavate or fusiform shape scattered throughout the length of the plant. Some branches may consist of one or two such cells (Fig. 7).

Plants of this species may be up to 15 cm high, but if growing in habitats where they are uncovered at low tide and subject to strong wave action they are generally shorter with a strong tendency towards the dichotomous habit. Such plants tend to be more robust and less branched than those growing in pools. Specimens with a fasciculate habit are reminiscent of Kützinger's (1854) figures of *C. neesiorum*, *C. humilis* and *C. ramosissima*, all of which de Toni (1889) regards as synonymous. *Cladophora capensis* is, however, coarser than *C. neesiorum*.

Levring (1938) and Papenfuss (1940) have stated that *C. capensis* and *C. ecklonii* are synonymous. In my opinion, *C. flagelliformis* sensu Levring is also the same species.



Fig. 1.

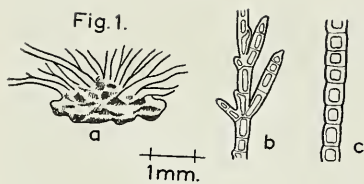


Fig. 3.

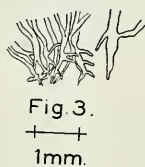
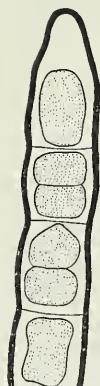
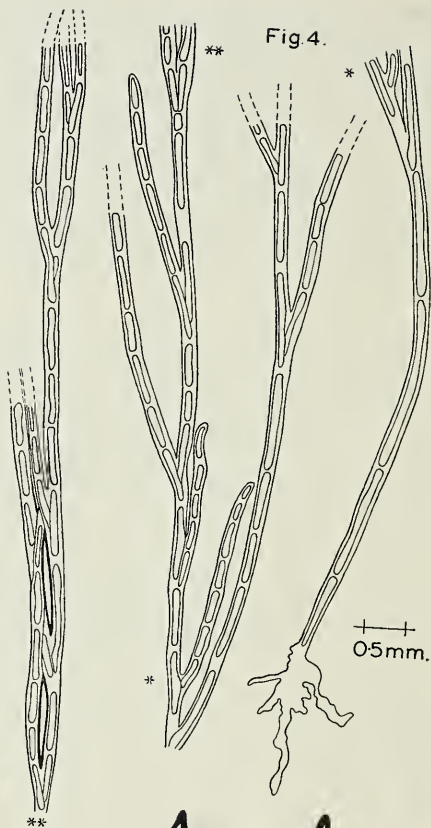
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Fig. 2.

Fig. 5.



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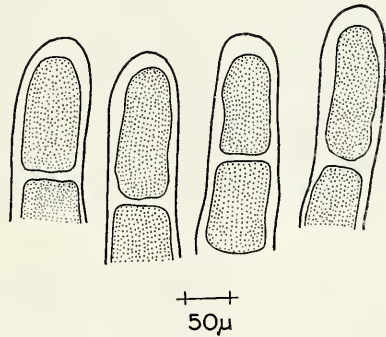
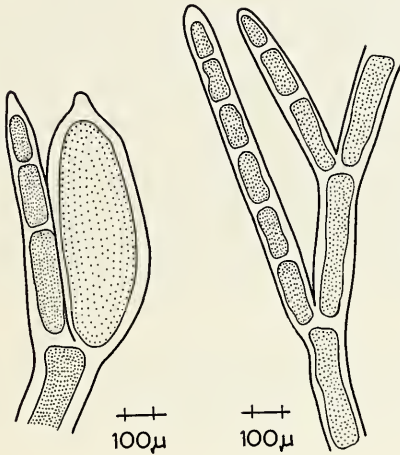
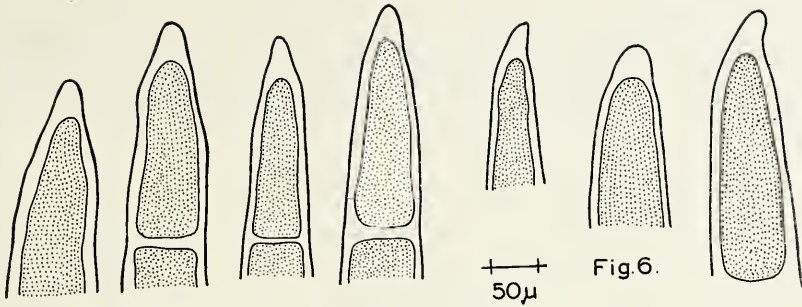


FIG. 1.—*C. virgata* (Ag.) Kütz. *a*, Hyaline disc forming holdfast; *b*, Short divergent naked branchlets; *c*, Cells near apex of branch.

FIG. 2.—Terminal portion of a branch of *C. virgata* (Ag.) Kütz. showing the obtuse tip of the apical cell.

FIG. 3.—Rhizoids at the base of the main filaments of *C. capensis* (Ag.) Kütz.

FIG. 4.—Near dichotomy of branches of *C. capensis* (Ag.) Kütz.

FIG. 5.—*C. capensis* (Ag.) Kütz. *a*, Dilated branch with dissolute terminal portion; *b*, Tapering branch with subacuminate tip; *c*, Coalescence of basal cell of branch with parent filament in upper portion of plant; *d*, Basal cell of branch in lower portion of plant; *e* and *f*, Apices of dilated branches.

FIG. 6.—Forms of apical cells in *C. capensis* (Ag.) Kütz.

FIG. 7.—Branchlet consisting of a single inflated cell in *C. capensis* (Ag.) Kütz.

FIG. 8.—Short divergent branches of *C. isaacii* sp. nov.

FIG. 9.—Bluntly rounded apices of branches of *C. isaacii* sp. nov.

### (3) *Cladophora isaacii* sp. nov.

Thallus erectus usque ad 40 cm altus, colore olivaceo-viride; fila primaria inferne ad  $200\ \mu$  lata; ramis elongatis, ordine tertia quoquoversum ramosis; ramulis ultimis brevioribus, gracilioribus, subdivaricatis usque ad  $80\ \mu$  latis, quoquoversum vel subsecundo exeuntibus; filis omnibus apices versus vix attenuatis; apicibus obtusis, rotundatis quam muris lateralibus usque ad 3-plo crassioribus incrassatis; cellulis inferioribus diametro 2-6-plo, superioribus 2-3-plo longioribus.

*Holdfast*: is formed of tightly interwoven rhizoids with dense contents of a dark green colour when fresh. The whole is not more than about 4 mm in diameter and is frequently higher than it is wide. There is no hyaline sheath surrounding the holdfast but closely appressed decurrent rhizoids arise from the lowest branches of the primary filaments resulting in some matting together of the main filaments below. *Erect System*, (i) *Branching*: Branches arise more or less spirally or sometimes oppositely and the ultimate branchlets are frequently short and divergent from the parent filaments (Fig. 8). There is a tendency for branchlets to arise in a second manner (Pl. 3), especially in the upper parts. Almost all branches taper slightly towards their tips. Main filaments and primary branches are elongated and end in a comparatively long naked portion which also tapers slightly to the apex. Some specimens have main filaments which branch furcately in their ultimate portions. These branches may become somewhat dilated upwards. Basal cells of elongated primary branches tend to coalesce with the parent filament and may appear to arise from the centre of a cell. (ii) *Cells of the Filaments*: In the basal parts these are four to six times longer than broad, and two to three times longer than broad higher up. In branches that dilate somewhat, the cells may be almost as broad as they are long. Such cells have denser contents than other filament cells and sometimes have become hyaline due to loss of contents, an occurrence presumably associated with reproduction. The apical cells of branches almost always have bluntly rounded tips and are scarcely narrower than their subterminal cells (Fig. 9).

Specimens of this species which I have found occurred typically in pools at about mid-tide level or higher and have been up to 25 cm in height. Some plants in the Tyson collection, which I consider to be the same species, are as much as 40 cm high. In the past this species has been mistaken for *C. capensis*. Its main differences from the latter species are given below.

### Comparison of the Three Species.

*C. virgata* is easily identified by its bluish-green colour, its disc holdfast and its branching habit, the branches usually being opposite or whorled with all branches dilating upwards and terminating in distinctive umbonately thickened apices. On the other hand, *C. capensis* and *C. isaacii* are much more similar in appearance and more likely to be confused. The main differences are seen in their branching habits. In *C. capensis* the branching is variable but the branchlets tend to be closely appressed to the parent filaments and taper gradually to rather acuminate apices with relatively thick end walls. The apical cell becomes more rapidly narrow towards its tip. In *C. isaacii* the shorter branches diverge from the parent filaments and all branches taper very little to bluntly rounded apices, whose end walls are thin in comparison with those of *C. capensis*. Moreover the apical cells of the latter species are longer relative to their breadth than those of *C. isaacii*. Inflated cells, scattered throughout the length of the plant, are common in *C. capensis* but have not yet been observed in *C. isaacii*. Plants of *C. capensis* are coarser than those of *C. isaacii* in the upper parts (cfr. Plates 2 & 3) and are generally much more rigid. The colour of the latter species is an olive green whereas *C. capensis* is a bright green. A further distinction is apparent in that *C. capensis* in drying sticks to paper only slightly but *C. isaacii* adheres well.

## SUMMARY.

It is shown that *C. virgata* (Ag.) Kütz. and *C. flagelliformis* (Suhr) Kütz. are synonymous, the former being the correct name. The account of *C. flagelliformis* by Levring (1938) is discussed and shown to refer to material not conforming with this species. It is suggested that *C. flagelliformis* in the sense used by Levring, Stephenson and Papenfuss (Tyson collection) is synonymous with *C. capensis* (Ag.) Kütz. A third species, *C. isaacii*, is discussed and described as new.

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PLATE 1.—Habit of upper portion of *C. virgata* (Ag.) Kütz., showing elongated flagelliform branches.



PLATE 2.—Habit of some specimens of *C. capensis* (Ag.) Kütz. showing several main filaments bearing fascicles of short branches throughout their length.

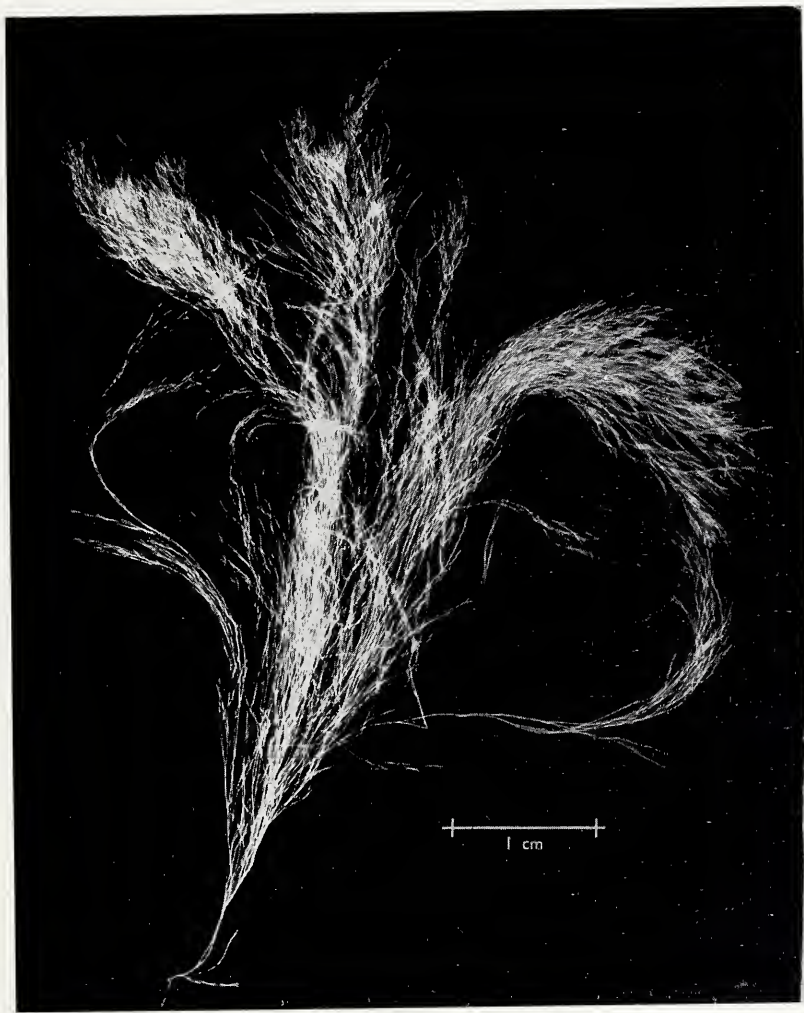


PLATE 3.—Habit of *C. isaacii*, showing second arrangement of branchlets in upper parts.





# Notes on *Aristothamnion purpuriferum* (Kütz.) J. Ag.

By

R. H. Simons.

## INTRODUCTION.

This South African seaweed is listed by Stephenson (8), and known by local phycologists, as *Pleonosporium purpuriferum* (Kütz.) de Toni. In Kylin's (6) recent publication on the genera of the Rhodophyceae it appears as *Aristothamnion purpuriferum*, by which name I shall discuss it. The purpose of the present paper is to record the occurrence of tetrasporangia and to discuss this plant's taxonomy.

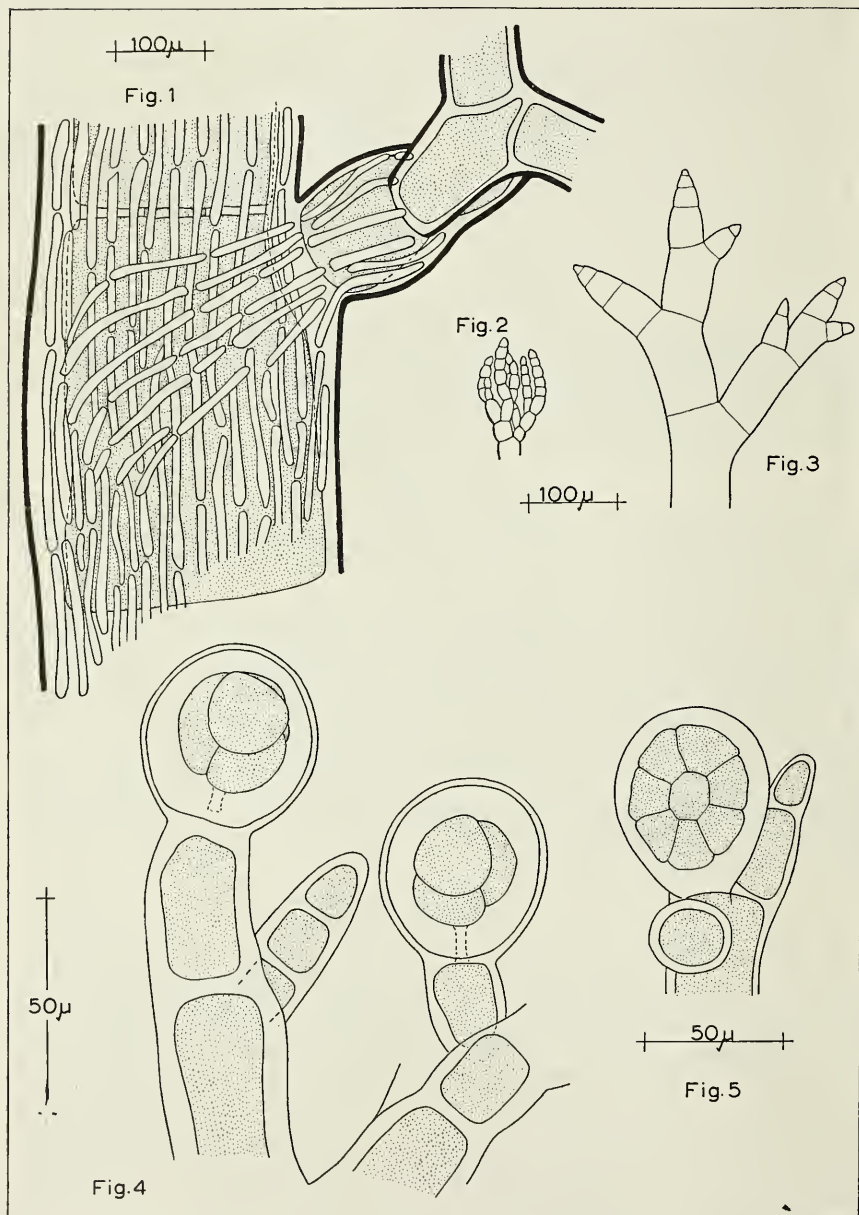
## MORPHOLOGY.

A full description of the morphology of *A. purpuriferum* has been given by Westbrook (9) who regarded it as a species of *Callithamnion*. For purposes of clarity its salient features are given here.

It is one of the species of Ceramiaceae with a well developed cortex made up of decurrent filaments arising at the lower ends of branches (Fig. 1). The ultimate branches are always uncorticated and two types can be distinguished—those of limited growth and those of unlimited growth. The apices of branches of unlimited growth have corymbosely clustered and inflexed branchlets (Fig. 2), but branches of limited growth have branchlets which spread and rapidly taper to acute apices (Fig. 3). The plants are typically dioecious with a separate sporophytic phase. Female organs are produced laterally on intercalary cells near the apices of branches of unlimited growth, whereas male organs occur laterally on intercalary cells of branches of limited growth. Both poly- and tetrasporangia have been recorded as lateral structures on intercalary cells of branches of limited growth.

## OBSERVATIONS.

In the many male and female plants I have examined the reproductive organs occurred in the positions noted above. On certain plants I have found polysporangia also occupying the position described for them. Such plants have borne no other type of reproductive structure. The only tetrasporangia observed have occupied an unexpected position. These arise on occasional plants bearing numerous female structures in all stages of development up to maturity and appearing therefore to be female plants. In these specimens the apical cell of a branch of unlimited growth is occasionally replaced by a subglobose swelling containing four tetrahedrally arranged spores (Fig. 4). The wall of such a sporangium is very thick and a distinct pit-connection is visible between the subtending vegetative cell and the spore group. These sporangia are nearly twice as wide as their subtending cells, but narrower than a mature polysporangium (Fig. 5). Tetrasporangia have a diameter of 25–35  $\mu$ ; an average sized polysporangium is 50  $\mu$  in diameter.



Further sporangium-like bodies with undivided contents are encountered in exactly similar positions to the tetrasporangia described above, but whether they are mature monosporangia or immature tetrasporangia I have not been able to ascertain. They appear to be more numerous than tetrasporangia but nevertheless occur only occasionally. Cystocarps have been observed arising lower down on branches terminating in either of these sporangial structures.

## RECORDS OF "ABNORMAL" TETRASPORANGIA AND THEIR SIGNIFICANCE IN THE CERAMIACEAE.

The occurrence of the tetrasporangia is "abnormal" in that they are produced on apparently female plants. Records of such occurrence are not uncommon in the Ceramiaeae, particularly in species of *Callithamnion*. Westbrook (10) records a single tetrasporangium arising terminally on a branch of a female plant of *C. tetricum*, an "abnormality" apparently similar to that now recorded for *A. purpuriferum*. The normal position of tetrasporangia of *C. tetricum* is on separate sporophytic plants where they are borne laterally on branches of limited growth, as are the polysporangia of *A. purpuriferum*. Westbrook did not investigate the cytology of the "abnormal" sporangia on *C. tetricum* but seemed to think that no reduction division accompanied the formation of their spores. She referred, however, to an account of *C. brachiatum* by Mathias (7) of similar "abnormal" sporangia in which there was meiosis. Drew (Fritsch 5) found reduction division taking place in the formation of tetraspores produced on plants of *Spermothamnion turneri*—a related species—bearing functional female organs. It is possible that conclusions similar to Drew's may result from cytological study of the "abnormal" sporangia of *C. tetricum* and *A. purpuriferum*.

The significance of the occurrence of reduction division in the production of such "abnormal" spores is that the plants bearing them are diploid and the carpospores resulting from the fertilisation of procarps arising on the same plants should be triploid. Drew found evidence of triploid carpospores developing on plants of *S. turneri* which also bore tetrasporangia. It is obvious that until the cytology of the "abnormal" sporangia in *A. purpuriferum* is investigated no conclusions may be drawn as to whether the plants producing them are haploid or diploid.

## OCCURRENCE OF TETRASPORES IN *A. PURPURIFERUM* IN RELATION TO ITS TAXONOMY.

There are apparently only two other references to the occurrence of tetrasporangia in *A. purpuriferum* both of which seem attributable to de Toni (3). Baardseth (2) questions the validity of de Toni's claim that tetrasporangia are produced by this plant;

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FIG. 1.—Origin of cortical filaments.

FIG. 2.—Ultimate branchlets of branch of unlimited growth.

FIG. 3.—Ultimate branchlets of branch of limited growth.

FIG. 4.—Tetrasporangia terminating ultimate branchlets.

FIG. 5.—Mature polysporangium above and developing polysporangium below on a cell of a branch of limited growth.

he could not find tetrasporangia in material he examined, and noted that this had also been the experience of Papenfuss, with whom he had communicated privately on this matter. Westbrook (9) also mentions the occurrence of tetrasporangia in this species but she did not find any in the plants she examined. Since she did not name her authority for this statement it seems likely that she accepted de Toni's record. Thus the evidence of most investigators of this plant is that normal tetrasporangia are not produced.

The absence of normal tetrasporangia in this species is taxonomically important because this was the character used originally by Agardh to separate the genus *Aristothamnion* from *Callithamnion*. Sporophytic plants of species of *Callithamnion* characteristically produce tetrasporangia in the asexual phase, whereas in *Aristothamnion* it is only polysporangia that are produced by plants of this phase. In all other respects the two genera are indistinguishable. Apparently de Toni regarded the production of polysporangia in members of the Ceramiaceae as taxonomically fundamental and placed all species with this feature in his genus *Pleonosporium*. Westbrook (9), however, did not share this view but placed more emphasis on the characters of male and female structures. Because the position and structure of the male and female organs are identical in *A. purpuriferum* and *Callithamnion* spp., but quite unlike those of *Pleonosporium* spp., Westbrook placed *A. purpuriferum* in the genus *Callithamnion*.

Feldman-Mazoyer (4) in her treatise on the Ceramiaceae of the Mediterranean, concluded that the structure and development of the female organs were the only reliable characters indicating relationships and leading to a natural classification within the family. This is partly in agreement with Westbrook's view and seems the most logical. Her conclusion as to the relationship of *A. purpuriferum* with *Callithamnion* was therefore justified. But she was under the impression that normal tetrasporangia were produced by this plant and there seemed no reason for separating it from the genus *Callithamnion* as was proposed by Agardh (1).

## CONCLUSIONS.

My record of tetrasporangia in *A. purpuriferum* is the first that has been made since de Toni's (3). The cytology of these structures has not been adequately investigated but they are "abnormal" in that they occur on plants bearing functional female organs. It would seem from the evidence of most investigators that sporophytic plants produce only polysporangia, and this character remains a point of difference between the genera *Aristothamnion* and *Callithamnion*. Although polysporangia are recorded for various species of *Callithamnion* they are accompanied by tetrasporangia (Fritsch 5, p. 729). Even if the tetrasporangia that I have described above should prove to arise on diploid plants forming a sporophytic phase of this species, their situation is not typical of species of *Callithamnion*. In this connection it should be noted that the tetrasporangia recorded by Mathias (7) as arising on sexual plants of *C. brachiatum* occurred in the lateral position normal for this genus. Also, Westbrook (10) found lateral tetrasporangia on the same female plant of *C. tetricum* which bore a single terminal tetrasporangium. It therefore seems appropriate at this stage to retain the name *Aristothamnion purpuriferum* (Kütz.) J. Ag. for the present species.

## SUMMARY.

A new record of tetrasporangia in *Aristothamnion purpuriferum* is given. These tetrasporangia are abnormal in that they occur on individuals bearing mature female organs. Their morphological and taxonomic significance is discussed and it is concluded that in the present state of our knowledge this plant should be known as *A. purpuriferum* (Kütz.) J. Ag.



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# Virus Diseases of Lupins.

By

Patricia J. Klessner.

Although virus infections of lupins have been known in South Africa for several years, no previous attempt has been made to identify the causal organisms. A preliminary report was published in 1953 (3).

## REVIEW OF LITERATURE.

The first record of viroses of lupins came from Germany in 1929 when Merkel (6) reported a pock mosaic and a speckle mosaic of yellow lupins.

Mastenbroek (5) described in detail what he considered to be the same virus. It was found to be seedborne in yellow lupin and only rarely transmissible to beans. He named it *Lupinus* virus 1.

In 1934, Neill, Brien and Chamberlain (7) described "Sore-shin" in New Zealand, and Richter (9) found an unidentified disease in Germany, both of which were later proved to be caused by the pea mosaic virus (1). Further work on this virus in lupins was done by Norris (8).

Kohler (4) reported the Lupinenbräune virus, later found to be the cucumber mosaic virus. In 1936 Spierenberg (10) in Holland, described a disorder, also later proved to be cucumber mosaic.

Weimer (11) described two viruses found in *L. angustifolius*, but does not confirm their identity. Neither of them is sap transmissible to lupins.

## METHODS AND MATERIALS.

Plants with suspected virus infections were collected from different parts of the Union.

The standard test plants used were: *Phaseolus vulgaris* var. Canadian Wonder, *Vicia faba* and *Pisum sativum* var. Greenfeast. In addition, about 30 other legumes, and some plants belonging to the *Solanaceae* were used in susceptibility tests.

*Aphis craccivora* was used for the insect transmission tests, but it is not necessarily the natural vector.

Mechanical sap transmission was aided by the use of carborundum powder, and the methods of Johnson and Grant (2) were used for the physical property tests.

This report deals with five viruses, and at the end of each section, there is a discussion on the relationship of the viruses concerned, and names are suggested for the new ones. These names are only tentatively proposed as no proof of virus identity is available beyond that of symptom and physical property resemblances.

## VIRUSES FOUND OCCURRING NATURALLY ON LUPINS.

<i>Host Plant.</i>	<i>Virus.</i>
<i>Lupinus affinis</i> .....	Lupin virus A. Pea mosaic virus 4.
<i>L. albus</i> .....	Lupin virus A. Lupin virus B. Lupin virus C. Bean yellow mosaic virus. Pea mosaic virus 4.
<i>L. angustifolius</i> .....	Lupin virus A. Lupin virus B. Lupin virus C. Bean yellow mosaic virus. Pea mosaic virus 4.
<i>L. luteus</i> .....	Lupin virus A. Pea mosaic virus 4.
<i>L. mutabilis</i> .....	Lupin virus A.

Lupins are also susceptible to most other legume viruses when inoculated artificially. With the spotted wilt virus they develop a local necrotic reaction. (See report on pea virus diseases.)

## SYMPTOMS FOUND ON LUPINS WHEN NATURALLY INFECTED.

*Lupinus affinis* with:

1. Lupin virus A.

The leaves are chlorotic and malformed, and rosetted. The plant is stunted.

2. Pea mosaic virus 4.

The leaves are chlorotic with necrosis setting in, and they are much reduced in size. There are necrotic stem streaks. The plant is stunted.

*Lupinus albus* with:

1. Lupin virus A.

A top necrosis usually causes the collapse of the growing point. Secondary shoots have chlorotic, malformed leaves and they are rosetted and stunted.

2. Lupin virus B.

Most leaves are small, malformed and chlorotic. Many drop and there may be a complete defoliation. There are necrotic stem streaks.

3. Lupin virus C.

The leaves have chlorotic spots and possibly necrotic specks. They remain folded and have wavy margins. The plant is stunted.

4. Bean yellow mosaic virus.

The leaves are mottled, they remain folded, and have wavy margins and a general puckering. There is a severe rosette and the plant is stunted. (Fig. 4a).

5. Pea mosaic virus 4.

There is a vein clearing, chlorotic ringspotting or mottle. The plant may be rosetted.



*Lupinus angustifolius* with:

1. Lupin virus A.

The leaves are chlorotic and malformed, and the plant is stunted and rosetted.

2. Lupin virus B.

The leaves are small and have necrotic specks. Most leaves drop. There are necrotic stem streaks.

3. Lupin virus C.

The leaves have a chlorotic speck mosaic and they are very small and crinkled. The plant is extremely rosetted and stunted. (Fig. 3a).

4. Bean yellow mosaic virus.

The leaves are mottled and there may be necrotic stem streaks which cause the collapse of the growing point. The leaves of the secondary shoots are vividly mottled, rolled and malformed.

5. Pea mosaic virus 4.

There is a mottle on the leaves with possibly a veinal necrosis which results in the collapse of the plant.

*Lupinus luteus* with:

1. Lupin virus A.

The leaves are chlorotic and malformed and the plant is rosetted and stunted.

2. Lupin virus B.

The leaves are mottled and puckered and the plant is rosetted.

*Lupinus mutabilis* with:

1. Lupin virus A.

There is a general chlorosis of the leaves which are also malformed, and rosetted. The plant is stunted.

### I. Lupin Virus A.

Physical properties: Thermal inactivation point, 58–60°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1 : 1000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Cicer arietinum* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L. var. Sweet, *L. albus* L. var. Bitter, *L. angustifolius* L., *L. luteus* L., *L. mutabilis* L., *Medicago lupulina* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L., *Vigna unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

### REACTION OF SUSCEPTIBLE SPECIES.

*Cicer arietinum*.

Local. No reaction.

Systemic. The young leaves develop a few small chlorotic spots.

*Crotalaria juncea.*

Local. Small necrotic specks develop.

Systemic. After a vein clearing in 24 days the leaves show an irregular chlorosis with dark green islands. The plant is stunted. Several young plants collapsed after a severe necrosis.

*C. spectabilis.*

Local. In 11 days chlorotic spots with a small central necrotic speck develop. These leaves drop.

*Glycine max.*

Local. No reaction.

Systemic. A diffuse chlorotic mottle develops.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. In 21 days there is a vein clearing of the young leaves followed by a streak mottle of leaves which are small and puckered.

*Lupinus albus* var. Sweet.

Local. There are chlorotic spots in 11 days and the veins may be necrotic in 18 days.

Systemic. There may be a vein clearing soon followed by a necrotic speckling which spreads and results in the collapse of the growing point. Secondary shoots have small leaves which are malformed with crinkled blistered dark green margins and a long narrow base (Fig. 1b.)

*L. albus* var. Bitter.

Local. No reaction.

Systemic. Necrosis sets in, in 11 days and the plant collapses.

*L. angustifolius.*

Local. No reaction.

Systemic. The young leaves may show a chlorotic spot mottle and there is a slight malformation with irregular margins. Later necrosis sets in, in the growing point and the plant collapses within three weeks (Fig. 1c).

*L. luteus.*

Local. No reaction.

Systemic. After 10 days the young leaves develop a chlorotic spotting and later a chlorotic mottle. The leaves remain folded and are almost stringlike and malformed. New leaves are small and rosetted (Fig. 1a).

*Medicago lupulina.*

Local. No reaction.

Systemic. After a vein clearing there is a chlorotic spot mottle and slight puckering.

*Melilotus officinalis.*

Local. No reaction.

Systemic. There are streaks which are almost yellow and ringspots which may become necrotic and cause a malformation.

*Phaseolus acutifolius.*

Local. In 7 days the leaves have chlorotic veins.

Systemic. In 12 days there is a vein clearing of the young leaves. The next leaves to develop are mottled, and still later ones have yellow specks.

*P. lunatus.*

A symptomless carrier.

*P. vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. The first and second trifoliates have large chlorotic blotches and are reflexed. After 14 days a chlorotic spotting develops on the young leaves which are also rolled. Later leaves develop a mottle with short dark green veinbands. There may be a slight malformation and puckering.

var. Haricot.

Local. In seven to eight days there is a reflexing and the leaves are generally chlorotic.

Systemic. Similar to Canadian Wonder.

vars. Long Tom, Tendergreen and Victor show a reaction similar to Canadian Wonder.

vars. Black Wonder, Idaho Refugee and S.A. Black and White develop large local chlorotic blotches. There is also a severe puckering of the leaves and the plant is stunted.

*Pisum sativum.*

Local. No reaction.

Systemic. A chlorotic spotting of the young leaves is followed by a mosaic with short dark green veinbands. Later leaves show a marked white vein etching, and they are small. The tendrils are abnormally curled.

*Trifolium hybridum.*

Local. No reaction.

Systemic. After three weeks a vein clearing develops into alternate chlorotic and green streaks following the veins.

*T. incarnatum.*

Local. Small chlorotic spots develop.

Systemic. In 18 to 19 days the young leaves develop chlorotic spots. Later leaves have a chlorotic mosaic and are crinkled.

*T. pratense.*

A symptomless carrier.

*T. repens.*

A symptomless carrier.

*Vicia faba.*

Local. No reaction.

Systemic. In 14 days there are chlorotic spots, and a clearing of the veins. Later leaves are mottled.

*Vigna unguiculata*.

Local. No reaction.

Systemic. A diffuse chlorotic network may develop. The virus can be recovered if symptomless.

*Voandzeia subterranea*.

Local. No reaction.

Systemic. There may be a diffuse chlorotic spotting, but the virus can be recovered if symptomless.

Natural source of virus: *Lupinus affinis* (Pretoria district), *L. albus*, *L. angustifolius*, *L. luteus*, and *L. mutabilis* (Stellenbosch district).

#### IDENTIFICATION.

Because of the characteristic reflexing of the bean leaves, this virus is compared with others showing this symptom.

Bean yellow mosaic virus Pierce causes a local necrosis on pea, is non-infectious to cowpea and has a shorter ageing period. Other details are similar, although the host range differs.

A necrotic strain of bean yellow mosaic virus Klessner, has similar physical properties, but induces a local and systemic necrosis of the pea and local necrosis on the cowpea.

Alsike clover mosaic virus 2 Zaumeyer gives a similar reaction on pea, but differs on other hosts.

Osborn's pea virus 2 differs in physical properties, host range and some symptoms.

As no complete correlation can be found, this is considered a new virus, related to the bean yellow mosaic group.

It is named lupin virus A.

#### 2. Lupin Virus B.

Physical properties: Thermal inactivation point, 62–65°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1: 100.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Cicer arietinum* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lupinus albus* L. var. Sweet, *L. albus* L. var. Bitter, *L. angustifolius* L., *L. luteus* L., *L. mutabilis* L., *Medicago lupulina* L., *M. sativa* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L., *Vigna unguiculata* (L.) Walp.

*Nicotiana glutinosa* L., *N. tabacum* L., *Solanum capsicum* L.

#### REACTION OF SUSCEPTIBLE SPECIES.

*Cicer arietinum*.

Local. Chlorotic spots with necrotic rings develop.

Systemic. After a vein clearing of the young leaves, later ones are long, narrow and malformed.

*Crotalaria juncea*.

Local. There are necrotic spots and veins.

Systemic. No reaction.



*C. spectabilis.*

Local. No reaction.

Systemic. In 11 days there is a clearing of the veins followed by small chlorotic spots, and later, a mottle. Necrosis sets in along the veins causing a puckering of the midrib and malformation. The plant may be severely stunted.

*Glycine max.*

Local. No reaction.

Systemic. There are chlorotic flecks on the younger leaves.

*Lupinus albus* var. Sweet.

Local. In nine days there are chlorotic spots and the leaflets collapse.

Systemic. At the same time chlorotic specks develop. On later leaves there is a general chlorosis leaving dark green blisters. The leaflets remain folded and are malformed (Fig. 2b). After a speck necrosis the plant is almost completely defoliated.

*L. albus* var. Bitter.

Local. No reaction.

Systemic. In 14 days there are chlorotic spots on the young leaves. Later leaves are mottled and stringlike. There is a slight necrosis and the leaves drop.

*L. angustifolius.*

Local. After a general necrosis the leaves collapse.

Systemic. There is a veinal necrosis of the young leaves, soon followed by necrotic stem streaks, and collapse of the plant (Fig. 2d).

*L. luteus.*

Local. No reaction.

Systemic. After 10 days there is a vein clearing of the young leaves, which remain folded, with wavy margins. Later leaves are stringlike and chlorotic and the plant is rosetted and stunted (Fig. 2a).

*L. mutabilis.*

Local. No reaction.

Systemic. Most leaves have irregular chlorotic areas.

*Medicago lupulina.*

Local. No reaction.

Systemic. A veinal chlorosis of the young leaves develops in 14 days. This becomes general, leaving dark green veinbands. The leaves are reduced, crinkled and puckered along the midrib.

*M. sativa.*

Local. No reaction.

Systemic. There are isolated chlorotic spots.

*Melilotus officinalis.*

Local. No reaction.

Systemic. Only a diffuse chlorotic mottle develops.

*Phaseolus acutifolius.*

Local. In seven days there are necrotic spots and veins on chlorotic leaves.

Systemic. After 12 days there is a vein clearing of the young leaves, and a yellow mottle and malformation of those formed later.

*P. lunatus.*

Local. No reaction.

Systemic. In 10 days there is a chlorotic network and later a speck mottle. Necrosis may set in, and the leaves become malformed.

*P. vulgaris* var. Canadian Wonder.

Local. Chlorotic spots with necrotic rings develop in 11 days (Fig. 2c.)

Systemic. There are only isolated chlorotic spots which become a diffuse mottle on later formed leaves. The pods are mottled.

## var. Haricot.

Local. There are necrotic specks on chlorotic leaves in seven days.

Systemic. The leaves show a chlorotic mottle and they are elongated. The pods are mottled.

*Pisum sativum.*

Local. After a general necrosis the leaves collapse.

Systemic. There is a vein chlorosis in six days followed by a mottle and sometimes a marked vein etching. The leaves are crinkled and rosetted. The plant is stunted and collapses from necrosis. The tendrils are tightly curled and twisted.

*Trifolium hybridum.*

Local. No reaction.

Systemic. In nine days there are chlorotic vein streaks and later a mild streak mottle on all leaves.

*T. incarnatum.*

Local. There may be necrotic specks.

Systemic. In two weeks the young leaves show a vein clearing. Later leaves have an almost white mosaic and are crinkled and rolled.

*T. pratense.*

Local. No reaction.

Systemic. After a month most leaves show vivid yellow spots and a mosaic.

*T. repens.*

A symptomless carrier.

*Vicia faba.*

Local. No reaction.

Systemic. The young leaves develop small chlorotic spots in seven days and those formed later are mottled. Some malformation occurs, leaving an uneven surface.

*Vigna unguiculata.*

Local. No reaction.

Systemic. There may be vein clearing and a chlorotic speckle. If symptomless, the virus can still be recovered.

*Nicotiana glutinosa.*

Local. Chlorotic spots and rings appear in seven days.

Systemic. A week later the young leaves develop chlorotic spots and then a mottle. The leaves are puckered and the plant is stunted.

*N. tabacum.*

Local. No reaction.

Systemic. The young leaves first develop chlorotic spots and then a mottle.

*Solanum capsicum.*

Local. No reaction.

Systemic. A chlorotic mottle concentrated at the base of the leaves appears after a month.

Natural source of virus: *Lupinus albus* (Pretoria and Stellenbosch), *L. angustifolius* (Stellenbosch).

## IDENTIFICATION.

Apart from the local reaction on the bean this virus shows some resemblance to several others.

Lupin virus B resembles the white clover mosaic virus complex Pierce, in that both cause a systemic chlorosis on the bean with a local and systemic necrosis on the pea. It differs from it in the reaction on the broad bean, and the type of local lesion on the French bean. Physical properties are also different.

Lupin virus B also resembles alsike clover mosaic virus 2 Zaumeyer as both cause a necrotic speckling and severe stunting of the pea, but differs from it in that the latter induces a marked reflexing of the leaves of the bean and there is no local reaction.

In his report on the sweet pea streak viruses Ainsworth mentions one which caused an identical local reaction on the bean viz. chlorotic spots with necrotic rings. Unlike lupin virus B, it also induced a reflexing of the bean leaves and eventual collapse of the plant. It also caused a local and systemic necrosis of the broad bean, and only a chlorosis of the pea.

The two types of bean yellow mosaic virus, viz. the local lesion and severe yellow strains of Zaumeyer, are similar in some respects, too.

The local lesion strain also causes a local reaction followed by a systemic mottle, on the bean, but only local lesions develop on the broad bean and cowpea, whereas the lupin virus B induces a systemic mottle on these hosts. Further, the host range and physical properties are dissimilar.

Like lupin virus B, the severe yellow strain causes a mottle on broad bean, and a mottle and necrosis on some varieties of pea, but unlike it, a systemic necrosis usually develops on the bean. Symptoms on other plants and the physical properties also differ.

The systemic symptoms on *Nicotiana glutinosa* are not unlike those of cucumber mosaic virus but further details are not similar.

Therefore, as there appears to be no complete correlation with any other virus, this is considered a new one. The name suggested is lupin virus B.

### 3. Lupin Virus C.

Physical properties: Thermal inactivation point, 56–58°C. Longevity *in vitro*, 1–2 days. Dilution end point, 1: 100.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Crotalaria spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L. var. Sweet, *L. albus* L. var. Bitter, *L. angustifolius* L., *L. luteus* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. vulgaris* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *Vigna unguiculata* (L.) Walp.

*Nicotiana glutinosa* L., *N. tabacum* L.

#### REACTION OF SUSCEPTIBLE SPECIES.

##### *Crotalaria spectabilis*.

Local. No reaction.

Systemic. The young leaves show chlorotic spots, each with a necrotic centre. Later this becomes a mosaic with dark green veinbands and necrosis setting in in the chlorotic areas. The leaves are slightly reduced in size, and puckered and curled.

##### *Glycine max*.

Local. There are necrotic lesions in 12 days.

Systemic. The first trifoliates develop chlorotic flecks with necrotic rings, and soon drop. Most other leaves have vivid chlorotic flecks and later a mosaic with necrotic specks.

##### *Lathyrus odoratus*.

Local. No reaction.

Systemic. There is a chlorotic streak mottle.

##### *Lupinus albus* var. Sweet.

Local. In nine days chlorotic spots with necrotic centres develop.

Systemic. In twelve days the young leaves show a vein clearing and chlorotic spotting. These leaves are rolled upwards but bent down from the pulvinus like an umbrella (Fig. 3b). They have dark green bands or raised blisters, and are rosetted at the top of the plant. Later necrosis sets in from the growing point, and extends down the stem until the plant collapses.

##### *L. albus* var. Bitter.

Local. No reaction.

Systemic. Within 15 days necrosis has caused the collapse of the plant.

##### *L. angustifolius*.

Local. No reaction.

Systemic. The leaves show only a diffuse mottling, but they are severely curled and folded. Later necrosis causes the leaves to drop.

##### *L. luteus*.

Local. No reaction.

Systemic. There is a vein clearing and spotting of the young leaves in 15 days. Later leaves are small with dark green blisters, and they remain folded. The plant is stunted.



*Melilotus officinalis.*

Local. No reaction.

Systemic. Chlorotic streaks and rings develop.

*Phaseolus acutifolius.*

Local. Chlorotic spots with necrotic rings develop.

Systemic. There is a chlorotic spotting.

*P. lunatus.*

A symptomless carrier.

*P. vulgaris* var. Canadian Wonder.

Local. Chlorotic spots with a necrotic ring develop in 12 to 13 days.

Systemic. There is a chlorotic mottle.

var. Haricot.

Local. There is a chlorotic spotting in seven days and later the leaves drop.

Systemic. The older trifoliates become long and narrow while the young leaves are malformed with a mottle or broad dark green veinbands.

vars. Idaho Refugee, S.A. Black and White and Tendergreen develop symptoms similar to Canadian Wonder.

*Trifolium hybridum.*

Local. No reaction.

Systemic. After a vein clearing there are diffuse chlorotic blotches.

*T. incarnatum.*

Local. Small necrotic lesions develop in 12 days.

Systemic. After a vein clearing there are chlorotic veinbands and a mosaic on the crinkled leaves. The plant is stunted.

*T. pratense.*

Local. No reaction.

Systemic. There are chlorotic streaks with necrosis setting in, which results in a malformation of the leaves. Some leaves may collapse from the necrosis.

*Vigna unguiculata.*

Local. In 5 days there are small necrotic spots and the leaves drop.

Systemic. The young leaves also show necrotic spots, and the plant may be completely defoliated.

*Nicotiana glutinosa.*

Local. Chlorotic spots and patterns develop in 7 days, sometimes with necrotic rings.

Systemic. In 9 days there are chlorotic spots, becoming a mottle on later leaves which are crinkled. The plant is stunted.

*N. tabacum.*

Local. Necrotic lesions, which enlarge and fuse, appear in 7 days.

Systemic. No reaction.

Natural source of virus: *Lupinus albus* and *Lupinus angustifolius* from Stellenbosch.

## IDENTIFICATION.

Like lupin virus B, this virus has similarities with, but cannot be related to, white clover mosaic virus complex Pierce, alsike clover mosaic virus 2 Zaumeyer, the two strains of bean yellow mosaic virus Zaumeyer and cucumber mosaic virus.

It has however, the same characteristic local reaction on the bean as lupin virus B, but differs from it, in its inability to infect either broad bean or pea. The symptoms on lupins are also dissimilar.

Despite the one link with lupin virus B, viz. the local reaction on bean, the virus seems distinct, and is named lupin virus C.

## 4. Bean Yellow Mosaic Virus Pierce.

Physical properties: Thermal inactivation point, 58–60°C. Longevity *in vitro*, 1–2 days. Dilution end point, 1: 1000–1: 2000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L. var. Sweet, *L. albus* L. var. Bitter, *L. angustifolius* L., *L. luteus* L., *Medicago lupulina* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L., *Voandzeia subterranea* Thouars.

## REACTION OF SUSCEPTIBLE SPECIES.

*Arachis hypogaea*.

Local. Diffuse chlorotic blotches develop.

Systemic. Most leaves have chlorotic ringspots or patterns, and the plant is stunted.

*Crotalaria juncea*.

Local. No reaction.

Systemic. The young leaves develop a chlorotic network in 9 days. On later leaves there is a chlorotic mottle with dark green blisters. These leaves are slightly malformed and have wavy margins.

*C. spectabilis*.

Local. There may be chlorotic spots surrounded by necrotic rings.

Systemic. After a vein clearing of the young leaves in 13 days, later ones develop broad dark green veinbands. The next leaves are mottled.

*Glycine max*.

Local. Small necrotic lesions develop in 12 days.

Systemic. The young leaves show chlorotic spots or flecks, and on the later ones there is a diffuse mottle.

*Lathyrus odoratus*.

Local. No reaction.

Systemic. In 3 weeks the young leaves show a vein clearing and chlorotic spotting. The next leaves are rolled and have a mosaic. There is a colour break on the flowers.

*Lupinus albus* var. Sweet.

Local. There are isolated chlorotic spots in 9 days and the leaves become flaccid.

Systemic. The young leaves remain folded and develop a vein clearing and chlorotic spotting after 16 days. Later leaves are mottled with dark green blisters. They are elongated, malformed and the margins are rolled (Fig. 4b).

*L. albus* var. Bitter.

Local. No reaction.

Systemic. After a severe necrosis the plant collapses. If secondary shoots develop, they are rosetted with small malformed leaves.

*L. angustifolius*.

Local. No reaction.

Systemic. The young leaves have a diffuse chlorotic spotting. Later ones are mottled.

*L. luteus*.

Local. Diffuse chlorotic areas may develop.

Systemic. The young leaves remain folded and have wavy margins, and are chlorotic. Later leaves are stringlike and malformed. The plant is severely rosetted and stunted.

*Medicago lupulina*.

Local. No reaction.

Systemic. The leaves develop a vein clearing and later a mottle. They are puckered along the midrib.

*Melilotus officinalis*.

Local. No reaction.

Systemic. After 3–4 weeks most leaves show chlorotic spots, streaks, rings or concentric patterns (Fig. 4c). The old leaves have a chlorotic etching.

*Phaseolus acutifolius*.

Local. No reaction.

Systemic. The young leaves curl back and have a yellow network. Later leaves are mottled.

*P. lunatus*.

Local. No reaction.

Systemic. Chlorotic vein slashes may develop in 2–3 weeks or the plant is a symptomless carrier.

*P. mungo*.

Local. Necrotic veins develop.

Systemic. A limited amount of veinal necrosis may occur.

*P. vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. The young leaves show a marked reflexing from the pulvini and they develop a vein clearing and flecking. Later formed leaves show a mottle and they are slightly malformed with an uneven surface. Most pods have dark green blisters.

var. Haricot.

Local. These leaves bend at right angles to the pulvini, and have diffuse chlorotic areas.

Systemic. The first trifoliates show a marked reflexing and have chlorotic spots. The young leaves are curled, small and mottled, and may have necrosis of the veins. The pods develop dark green blisters with necrosis.

vars. Black Wonder, Idaho Refugee, Long Tom, S.A. Black and White, Tendergreen and Victor develop the typical systemic reaction.

vars. Black Wonder, Idaho Refugee, Long Tom and Tendergreen also show a local chlorosis.

*Pisum sativum*.

Local. A spreading necrosis causes the leaves to collapse in 14 days.

Systemic. After a vein clearing in 7 days there is a chlorotic spotting followed by a mosaic. The leaves are small, the tendrils are abnormally curled and the plant is stunted.

*Trifolium hybridum*.

Local. No reaction.

Systemic. After a vein clearing in 15 days the leaves have chlorotic streaks.

*T. incarnatum*.

Local. No reaction.

Systemic. In 12 days there is a vein clearing and chlorotic spotting. Later leaves develop a mosaic.

*T. pratense*.

A symptomless carrier.

*T. repens*.

A symptomless carrier.

*Vicia faba*.

Local. The leaves may become flaccid and drop.

Systemic. Within 7 days the young leaves develop a spotting or mottle. Later ones are slightly malformed and have chlorotic patterns.

*Voandzeia subterranea*.

Local. No reaction.

Systemic. A diffuse mottle develops.

Natural source of virus: *Lupinus albus* (Pretoria) and *L. angustifolius* (Stellenbosch).

#### IDENTIFICATION.

The reflexing of the leaves of *Phaseolus vulgaris* is a characteristic of four viruses or strains.

Only with bean yellow mosaic virus is this reflexing also associated with similarity in physical properties, host range and symptoms on other hosts. This virus is therefore considered to be bean yellow mosaic virus.



### 5. Pea Mosaic Virus 4 Zaumeyer.

Physical properties: Thermal inactivation point, 60°–65°C. Longevity *in vitro*, 3–4 days. Dilution end point, 1: 5000–1: 10000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L. var. Sweet, *L. albus* L. var. Bitter, *L. angustifolius* L., *L. luteus* L., *Medicago lupulina* L., *M. sativa* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium fragiferum* L., *T. hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L., *Vigna unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

#### REACTION OF SUSCEPTIBLE SPECIES.

##### *Crotalaria juncea*.

Local. No reaction.

Systemic. After 2 weeks there is a mosaic with irregular chlorotic areas and dark green blisters. Later leaves are malformed and stringlike, and the plant is stunted.

##### *C. spectabilis*.

Local. Chlorotic spots with small necrotic centres develop in 10–11 days.

Systemic. The young leaves develop chlorotic spots. The next formed are chlorotic with almost white streaks and dark green blisters. There is a slight malformation.

##### *Glycine max*.

Local. Chlorotic spots develop in 4–5 days.

Systemic. After a month the leaves show a chlorotic spotting. The older ones also have necrotic specks. The plant is stunted.

##### *Lathyrus odoratus*.

Local. No reaction.

Systemic. After 3 weeks there are chlorotic veinbands followed by a streak mottle on later leaves.

##### *Lupinus albus* var. Sweet.

Local. After 11 days there is a general chlorosis leaving dark green veinbands. The leaves become flaccid and drop.

Systemic. The young leaves develop a vein clearing and remain folded (Fig. 5b). Later leaves show an irregular chlorosis with dark green blisters. They are malformed, elongated or even stringlike, and rolled (Fig. 5d).

##### *L. albus* var. Bitter.

Local. No reaction.

Systemic. The plant collapses after a necrosis.

*L. angustifolius.*

Local. No reaction.

Systemic. A diffuse chlorotic mottle develops in 18 days.

*L. luteus.*

Local. No reaction.

Systemic. In 14-15 days the young leaves show a vein clearing and spotting. Later leaves are small and malformed and have dark green blisters (Fig. 5c). The plant is stunted and rosetted (Fig. 5a).

*Medicago lupulina.*

Local. No reaction.

Systemic. There is a vein clearing and spotting of the young leaves. Later ones have irregular chlorotic areas, and are slightly puckered along the midrib.

*M. sativa.*

Local. No reaction.

Systemic. The leaves develop diffuse chlorotic spots.

*Melilotus officinalis.*

Local. No reaction.

Systemic. There may be chlorotic spots or streaks, or the plant may be a symptomless carrier.

*Phaseolus acutifolius.*

Local. No reaction.

Systemic. The young leaves curl down severely. They are mottled and have dark green blisters. Later leaves have yellow specks.

*P. lunatus.*

A symptomless carrier.

*P. vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. The centre leaflet of the first trifoliates shows a marked reflexing. Chlorotic spots develop in 12-13 days and on later leaves there is a mottle. The leaves are crinkled.

var. Haricot.

Local. The leaves bend at right angles to the petiole and may have necrotic specks.

Systemic. As for Canadian Wonder, but there is also a malformation of the leaves. There may be a necrosis of the growing point, which results in the collapse of the plant.

vars. Black Wonder, Long Tom, S.A. Black and White, Tendergreen and Victor show similar symptoms to those of Canadian Wonder.

vars. Long Tom and S.A. Black and White also develop a local chlorosis in 3 days.

*Pisum sativum.*

Local. No reaction.

Systemic. After a preliminary vein clearing and spotting, a diffuse mottle develops (Fig. 5e).

*Trifolium fragiferum.*

A symptomless carrier.

*T. hybridum.*

Local. No reaction.

Systemic. The vein clearing is vivid, and is followed by alternate chlorotic and green streaks, with occasional intervenal spots.

*T. incarnatum.*

Local. No reaction.

Systemic. There is a vein clearing of the young leaves in 14 days. Later leaves develop a mosaic and crinkling. The plant is stunted.

*T. pratense.*

Local. No reaction.

Systemic. There are chlorotic ringspots and streaks on most leaves. On the younger leaves a veinal necrosis may develop which causes a slight malformation.

*T. repens.*

Local. No reaction.

Systemic. There is vein clearing after 3 weeks which is followed by chlorotic streaks.

*Vicia faba.*

Local. No reaction.

Systemic. After 14 days the young leaves develop chlorotic spots, and later leaves have a mosaic. The old leaves show a chlorotic network.

*Vigna unguiculata.*

A symptomless carrier.

*Voandzeia subterranea.*

Local. No reaction.

Systemic. There may be a diffuse chlorotic spotting.

Natural source of virus: *Lupinus affinis* (Pretoria and district) *L. albus*, *L. angustifolius* and *L. luteus* (Stellenbosch).

## IDENTIFICATION.

Of the viruses causing the characteristic reflexing of the leaves of the bean, most similarity is shown to the pea mosaic virus 4 Zaumeyer, and this virus is considered to be the same, or very closely related to it.

## HOST RANGES.

Host Plant.	Lupin Virus A.	Lupin Virus B.	Lupin Virus C.	Bean Yellow Mosaic Virus.	Pea Mosaic Virus 4.
<i>Arachis hypogaea</i> .....	—	—	—	+	—
<i>Cicer arietinum</i> .....	+	+	—	—	—
<i>Crotalaria juicea</i> .....	+	+	—	+	+
<i>C. spectabilis</i> .....	+	+	+	+	+
<i>Dolichos lablab</i> .....	—	—	—	—	—
<i>Glycine javanica</i> .....	—	—	—	—	—
<i>G. max</i> .....	+	+	+	+	+
<i>Lathyrus odoratus</i> .....	+	+	+	+	+
<i>Lupinus albus</i> Sweet.....	+	+	+	+	+
Bitter.....	+	+	+	+	+
<i>L. angustifolius</i> .....	+	+	+	+	+
<i>L. luteus</i> .....	+	+	+	+	+
<i>L. mutabilis</i> .....	+	+	—	—	+
<i>Medicago lupulina</i> .....	+	+	—	+	+
<i>M. sativa</i> .....	—	+	—	—	+
<i>Melilotus officinalis</i> .....	+	+	+	+	+
<i>Phaseolus acutifolius</i> .....	+	+	+	+	+
<i>P. lunatus</i> .....	+	—	+	+	+
<i>P. mungo</i> .....	—	—	—	+	—
<i>P. vulgaris</i> .....	+	+	+	+	+
<i>Pisum sativum</i> .....	+	—	—	+	+
<i>Trifolium fragiferum</i> .....	—	—	—	—	—
<i>T. hybridum</i> .....	+	+	+	+	+
<i>T. incarnatum</i> .....	+	+	+	+	+
<i>T. pratense</i> .....	+	+	+	+	+
<i>T. repens</i> .....	+	+	—	+	+
<i>Vicia faba</i> .....	+	+	—	+	+
<i>Vigna sesquipedalis</i> .....	—	—	—	—	—
<i>V. unguiculata</i> .....	+	+	+	—	+
<i>Voandzeia subterranea</i> .....	+	—	—	+	+
<i>Nicotiana glutinosa</i> .....	—	+	+	—	—
<i>N. tabacum</i> .....	—	+	+	—	—

## PHYSICAL PROPERTIES AND METHODS OF TRANSMISSION.

Virus.	Thermal Inactivation Point.	Longevity <i>in vitro</i> .	Dilution End Point.	Transmission.		
				Sap.	Seed.	Aphis.
Lupin virus—						
A.....	58–60°C	2–3 days	1 : 1000	+	—	+
B.....	62–65°C	2–3 days	1 : 100	+	—	+
C.....	56–58°C	1–2 days	1 : 100	+	—	+
Bean yellow mosaic virus.....	58–60°C	1–2 days	1 : 1000	+	—	—
Pea mosaic virus 4.....	60–65°C	3–4 days	1 : 5000	+	—	+



## SYMPTOMS ON THREE MAIN TEST PLANTS.

Virus.	<i>Phas. vulgaris.</i>	<i>Vicia faba.</i>	<i>Pisum sativum.</i>
Lupin Virus A.....	Local—neg. Syst.—reflex., chl. mot.	Local—neg. Syst.—c.sp., c. mot.	Local—neg. Syst.—c. mot.
Lupin Virus B.....	Local—chl. sp., necr. O. Syst.—chl. spots	Local—neg. Syst.—c. mot., malf.	Local—necrosis. Syst. c. mot., necr.
Lupin Virus C.....	Local—chl. sp., necr. O. Syst.—chl. mot.	Local—neg. Syst.—neg.	Local—neg. Syst.—neg.
Bean Yellow Mosaic Virus	Local—neg. Syst.—reflex., mot., malf.	Local—flaccid. Syst.—c. sp. mos.	Local—necrosis. Syst.—mos., stunt.
Pea Mosaic Virus 4....	Local—neg. Syst.—reflex., mot.	Local—neg. Syst.—mos.	Local—neg. Syst.—c. mot.

SYMPTOMS ON THREE MAIN *LUPINUS* HOST PLANTS.

Virus.	<i>L. albus</i> —Sweet.	<i>L. angustifolius.</i>	<i>L. luteus.</i>
Lupin Virus A.....	Local—chl. and necr. Syst.—necr.	Local—neg. Syst.—c. mot., necr.	Local—neg. Syst.—c. mot., malf., ros.
Lupin Virus B.....	Local—chl. Syst.—c. mot., necr.	Local—necr. Syst.—necr.	Local—neg. Syst.—c. mot., stringlike.
Lupin Virus C.....	Local—chl. and necr. Syst.—c. mot., necr.	Local—neg. Syst.—c. mot., crinkle	Local—neg. Syst.—dgr. blist., stunt.
Bean Yellow Mosaic Virus	Local—chl. Syst.—c. mot., malf.	Local—neg. Syst.—chl. mot., csp.	Local—chl. Syst.—chl., malf., stunt.
Pea Mosaic Virus 4....	Local—chl., veinb. Syst.—c. mot., stringlike	Local—neg. Syst.—chl. mot.	Local—neg. Syst.—dgr. blist., stunt.

## ABBREVIATIONS USED:—

chl.—chlorosis, chlorotic.  
c. mot.—chlorotic mottle.  
c. sp.—chlorotic spots.  
dgr. blist.—dark green blisters.  
malf.—malformation.  
mos.—mosaic.

neg.—negative.  
necr.—necrosis or necrotic.  
reflex.—reflexing.  
ros.—rosette.  
veinb.—veinbands.  
O.—rings.

## SUMMARY.

Lupins in South Africa are naturally infected by five viruses:

1. Bean yellow mosaic virus was found on *Lupinus albus* and *L. angustifolius* at Pretoria and Stellenbosch. This is the first report of the presence of this virus in South Africa.
2. Pea mosaic virus 4 was found on *L. affinis*, *L. albus*, *L. angustifolius* and *L. luteus* in the Pretoria district and Stellenbosch. It is also reported for the first time.

3. Lupin virus A was found on *L. affinis*, *L. albus*, *L. angustifolius*, *L. luteus* and *L. mutabilis*. It is possibly related to the bean yellow mosaic virus group.
4. Lupin virus B was found on *L. albus* and *L. angustifolius*. This is apparently a new virus.
5. Lupin virus C was found on *L. albus* and *L. angustifolius*, and also seems to be a distinct entity, possibly related to lupin virus B.

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FIG. 1.—LUPIN VIRUS A.

A. *Lupinus luteus*. B. *L. albus*. C. *L. angustifolius*. Artificial infections.

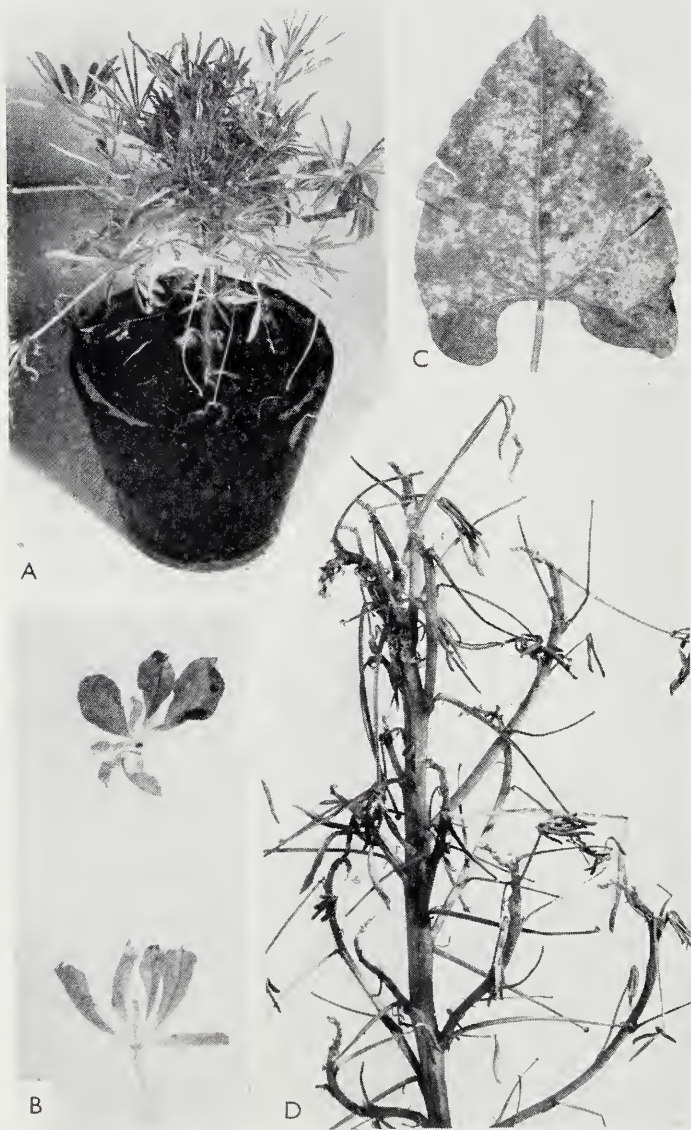


FIG. 2.—LUPIN VIRUS B.

A. *Lupinus luteus*. B. *L. albus*. C. *Phaseolus vulgaris*. Artificial infections.  
D. *L. angustifolius*—natural infection.





FIG. 3.—LUPIN VIRUS C.

A. *Lupinus angustifolius*—natural infection.

B. *L. albus*—artificial infection.



FIG. 4.—BEAN YELLOW MOSAIC VIRUS.

A. *Lupinus albus*—natural infection.

B. *L. albus*—artificial infection.

C. *Melilotus officinalis*—artificial infection.

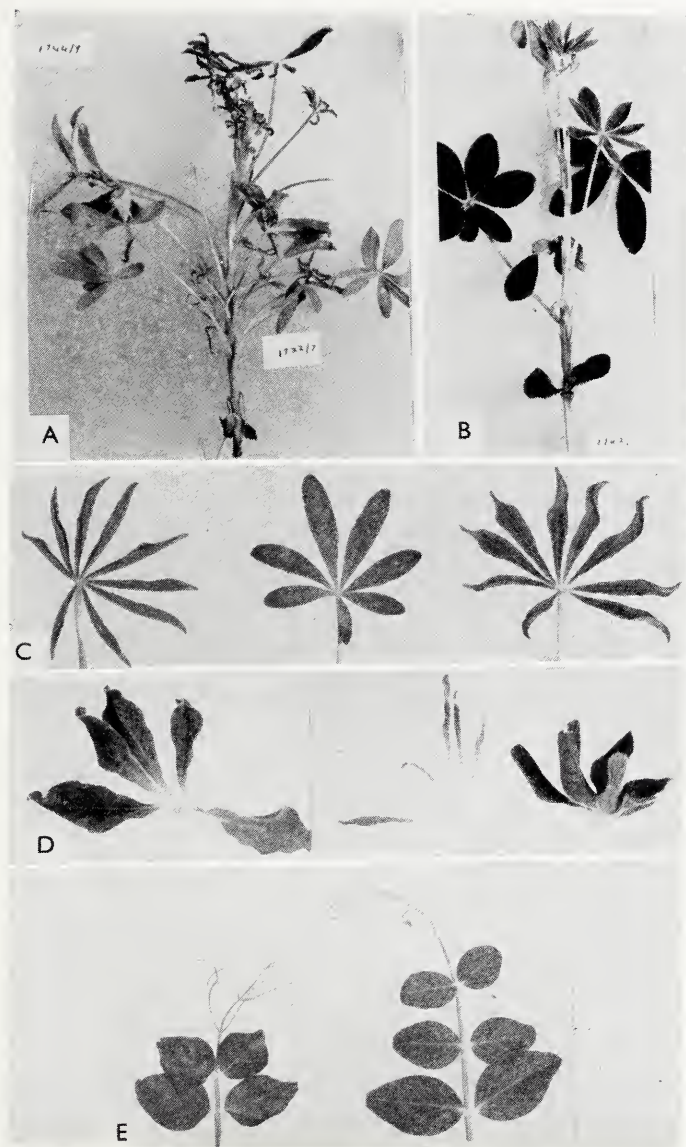


FIG. 5.—PEA MOSAIC VIRUS 4.

A. and C. *Lupinus luteus*. B. and D. *L. albus*.

E. *Pisum sativum*. Artificial infections.





# Virus Diseases of Cowpeas.

By

Patricia J. Klessner.

Virus infections of cowpea, *Vigna unguiculata*, are common in South Africa. There are three types of symptom found in the field viz. a vivid yellow mosaic with dark green blisters; dark green veinbands with necrosis and severe malformation, and a mild veinbanding or mosaic. There is no evidence of seed transmission but *Aphis* species are efficient vectors.

## REVIEW OF LITERATURE.

The first reports of mosaic diseases of *Vigna* species were by McClintock (1917), Elliot (1921) and Elmer (1925). Smith (1924) established that a virus causing mosaic symptoms on cowpea was transmissible by a leaf-beetle, *Ceratoma trifurcata*. In 1929, Briant & Martyn recorded the transmission of a mosaic of *V. catjang* in Trinidad; and the following year Smith & Barker described a virus causing severe stunt and chlorosis on cowpeas in Haiti. Yu reported a mosaic of cowpea in China in 1939.

Detailed descriptions of viroses of *Vigna* spp. are given by McLean—a seed-borne mosaic of cowpea (19); Snyder—a seed-borne mosaic of asparagus bean (31); Vasuvada—a mosaic of *V. catjang* in India (32); Yu—cowpea mosaic in China (41); d'Oliviera—cowpea mosaic viruses 1, 2 and 3 (11); Dale—a cowpea mosaic transmitted by a leaf-beetle (8 and 9); Warid & Plakidas—cowpea mosaic viruses with extremely high thermal inactivation points (35) and Anderson (3b). Capoor *et al* described mosaic diseases of *V. catjang* (6) and *V. cylindrica* (7).

Price (21) was the first to report a strain of cucumber mosaic virus (strain Y) which caused a systemic reaction as well as the usual local lesions on cowpea. Later Whipple & Walker (38) described strains 14 and 17, and Fulton found strains A–F on spinach (14). Anderson (3a) recorded yet another strain, also systemic on cowpea.

Sill & Walker (26a and b) when working on the optimum conditions for local lesion production on cowpea with cucumber mosaic virus, found that some lines of cowpeas became systemically infected. Sinclair & Walker (25) determined that this factor was controlled by the mutation of a single gene pair.

Other legumes which can be naturally infected with strains of cucumber mosaic virus are peas and beans, Whipple & Walker (38), and Hagedorn (15), sweet peas, Ainsworth (2) and lima bean, Harter (16).

Several viruses, when inoculated artificially induce local lesions only on cowpea, viz. tobacco ringspot, Wingard (39); tobacco necrosis, Smith & Bald (30); potato calico, Black & Price (4); tomato bushy stunt, Smith (28); alfalfa mosaic 1, Zaumeyer (43) and Black & Price (4); alfalfa mosaic 1A, 1B and 2, Zaumeyer (43) and pea wilt, Johnson (17).

The curly top virus causes severe stunt of the plant and proliferation of the leaves of cowpea, Severin & Henderson (24).

## METHODS AND MATERIALS.

The following three viruses were isolated from naturally infected cowpeas found in several districts of the Transvaal.

The standard test plants used were: *Phaseolus vulgaris* var. Canadian Wonder, *Vicia faba* and *Pisum sativum* var. Greenfeast; also *Nicotiana tabacum* var. White Burley, *N. glutinosa*, *Cucumis sativus*, and *Zinnia elegans* as so many cowpea viruses are related to the cucumber mosaic virus group. In addition, about 30 other legumes were included in the susceptibility tests.

Carborundum powder was used for the mechanical sap inoculations, and *Aphis craccivora* for the insect transmissions. (This aphid was used solely as a criterion of whether or not the viruses were indeed aphid transmissible.)

In this report three virus diseases found naturally on cowpea are described and compared with those already recorded in the literature.

During this survey of legume virus diseases, cowpea was found to be susceptible to many other legume virus when inoculated artificially. It also produced local necrotic lesions with the tomato spotted wilt virus.

## 1. Cowpea Mosaic Virus A.

Physical properties: Thermal inactivation point, 62–65°C. Longevity *in vitro*, 2–4 days. Dilution end point, 1: 2000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Dolichos lablab* L., *Glycine javanica* L., *G. max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., vars. sweet and bitter, *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *M. sativa* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium fragiferum* L., *T. hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

## REACTION OF SUSCEPTIBLE SPECIES.

*Arachis hypogaea*.

Local. No reaction.

Systemic. The leaves are crinkled, and chlorotic with dark green veinbands.

*Crotalaria juncea*.

Local. There are necrotic specks with chlorotic rings. The leaves drop.

Systemic. After a vein clearing and spotting in 10 days, the leaves develop a mottle with dark green blisters and veinbands. There are also necrotic specks. These leaves are crinkled and malformed with constrictions of the laminae. The plant is rosetted.

*C. spectabilis*.

Local. No reaction.

Systemic. After 13 days there is a vein clearing and chlorotic spotting and flecking of the young leaves. The next leaves develop irregular chlorotic areas with dark green veinbands and islands. These leaves are rolled, crinkled and slightly malformed.

*Dolichos lablab*.

Local. No reaction.

Systemic. There are diffuse chlorotic areas.

*Glycina javanica.*

Local. There are necrotic spots with chlorotic rings in 4 days.

Systemic. The leaves may have chlorotic areas or, if symptomless, the virus can be recovered.

*G. max.*

Local. Chlorotic spots may develop.

Systemic. There is a chlorotic spotting and vein flecking in 9 days. The next leaves develop a mottle with dark green blisters and irregular yellow areas. They are elongated and malformed with a crinkled surface. The older leaves have necrotic specks.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. There are dark green veinbands on most leaves, which are also rolled. The plant is stunted.

*Lupinus albus* var. Sweet.

Local. There are dark green lesions on chlorotic leaves in 9 days and the leaves drop.

Systemic. At the same time the young leaves remain folded and have wavy margins, with a vein clearing and later spotting. The plant remains stunted. Necrotic specks develop later and the plant collapses.

*L. albus* var. Bitter.

Local. No reaction.

Systemic. The young leaves remain small and are chlorotic with dark green blisters. They are rosetted and have twisted tips. Necrosis sets in and many leaves drop.

*L. luteus.*

Local. Necrotic specks develop in 10 days.

Systemic. The young leaves remain folded and have twisted tips and chlorotic spots. Later leaves are mottled with dark green veinbands. They are small, rolled and malformed. Necrosis may set in and the leaves drop. The plant is stunted.

*L. mutabilis.*

Local. No reaction.

Systemic. The leaves are mottled with dark green blisters. The plant is rosetted and stunted.

*Medicago lupulina.*

A symptomless carrier.

*M. sativa.*

Local. No reaction.

Systemic. There is a chlorotic spotting with necrotic specks.

*Melilotus officinalis.*

A symptomless carrier.

*Phaseolus acutifolius.*

Local. There are chlorotic spots in 6 days.

Systemic. After a vein clearing of the young leaves in 9 to 10 days, most later leaves have a speck mottle.

*P. lunatus.*

Local. Large chlorotic blotches develop.

Systemic. The young leaves develop a vein clearing in 6 to 7 days (Fig. 1f). Later leaves have chlorotic vein flecks or irregular areas which become necrotic (Fig. 1e). These leaves may be crinkled.

*P. mungo.*

Local. There are necrotic spots, ringspots and veins in 7 days.

Systemic. In 3 weeks the young leaves may develop chlorotic specks which soon become necrotic.

*P. vulgaris* var. Canadian Wonder.

Local. In 4 days there are chlorotic spots which later have necrotic rings.

Systemic. The young leaves develop a vein clearing and chlorotic spotting in 6 days. Later leaves are mottled.

## var. Haricot.

Local. In 4 days there are chlorotic spots which spread and fuse. There are also necrotic ringspots and veins.

Systemic. In 10 days the young leaves curl down and develop a vein clearing. These veins become necrotic and there are necrotic stem streaks. The plant is stunted and usually collapses.

*Pisum sativum.*

Local. No reaction.

Systemic. After a vein clearing and spotting there is a chlorotic mottle. The leaves may be slightly malformed and rosetted and the tendrils abnormally curled.

*Trifolium fragiferum.*

Local. There are necrotic rings on chlorotic leaves.

Systemic. No reaction.

*T. hybridum.*

Local. No reaction.

Systemic. Many leaves develop chlorotic streaks and spots.

*T. incarnatum.*

Local. The veins become necrotic and there are necrotic spots.

Systemic. The young leaves develop a vein clearing in 10 days, and later leaves have a chlorotic spotting, streaking, or mosaic with necrosis setting in, in the chlorosis. These leaves are crinkled, puckered and small. The plant is stunted and may later collapse.



*T. pratense.*

Local. No reaction.

Systemic. After a vein clearing of the young leaves in 18 to 19 days, later ones show a broad dark green midrib with chlorotic leaf margins. Some plants were symptomless carriers.

*T. repens.*

A symptomless carrier.

*Vicia faba.*

Local. There are necrotic ringspots on chlorotic leaves.

Systemic. In 3 weeks there is a chlorotic mottle.

*Vigna sesquipedalis.*

Local. There are chlorotic spots in 6 days.

Systemic. The young leaves show a vein clearing and spotting in 10 to 11 days. The next formed leaves are mottled with dark green veinbands and they are malformed. The old leaves become necrotic and drop.

*V. unguiculata.*

Local. There are necrotic spots in 5 days and there may be a slight veinal necrosis (Fig. 1a). The leaves show a marked epinasty and soon drop.

Systemic. The young leaves develop a vein clearing and flecking in 12 days. The next formed leaves have chlorotic spots and veinbands becoming a mosaic (Fig. 1b). Necrotic specks develop causing malformation and later these leaves drop (Fig. 1d). The plant is stunted and there are necrotic stem streaks (Fig. 1c).

*Voandzeia subterranea.*

Local. There are chlorotic spots in 6 days.

Systemic. After 13 days the young leaves develop a chlorotic network and spotting. Later leaves are mottled with dark green blisters and are contorted. The old leaves may develop a necrotic sheen.

Natural source of virus: *Vigna unguiculata*.

The plants were stunted. The younger leaves had chlorotic spots, dark green veinbands or a mosaic; and they were small and malformed. Older leaves showed varying amounts of necrosis in the chlorotic areas.

## IDENTIFICATION.

According to Anderson (3b) in a classification of the known cowpea viruses, most are seed-borne. Exceptions are the mosaics described by d'Oliviera (11) and Dale (9) and the cucumber mosaic virus strains.

Cowpea mosaic viruses 2 and 3 d'Oliviera cause only systemic symptoms on cowpea, whereas this virus induces a marked local reaction as well. The thermal inactivation point is about 70°C but this virus withstood 62–65°C only.

d'Oliviera's cowpea mosaic virus 1 has a lower deathpoint (about 60°C) and causes both local and systemic symptoms on cowpea, but too few details are available for a complete comparison.

The cowpea mosaic of Da'e is not transmissible by aphid, but by a leaf-beetle; and it withstands a much longer ageing period (20 days) and higher dilution (1: 100,000) than the virus described here.

In summing up the five groups of cowpea viruses, Anderson reports that none are able to infect *Medicago sativa*, *Trifolium incarnatum* or *Lathyrus odoratus*, all of which are susceptible to this virus. Further, the viruses of Yu (41), McLean (19) and Anderson (3b) are unable to infect the bean, and Snyder's (31) virus appears to be confined to *Vigna* spp.

The extremely high thermal inactivation points (98–104°C.) of Warid's *Vigna* viruses 1, 2, 3 and 3A and complexes 1, 2 and 3 exclude them from this comparison (35).

The virus described here is therefore considered to be a new entity belonging to the cowpea mosaic group, and is named cowpea mosaic virus A.

## 2. Cowpea Mosaic Virus B.

Physical properties: Thermal inactivation point, 60–62°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1: 1000.

Transmission: Mechanical sap inoculation. Insect vector—probably an aphid but results were inconclusive.

Host range: *Crotalaria juncea* L., *C. spectabilis* Roth., *Dolichos lablab* L., *Glycine javanica* L., *G. max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., vars. sweet and bitter, *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium incarnatum* L., *T. pratense* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

### REACTION OF SUSCEPTIBLE SPECIES.

#### *Crotalaria juncea*.

Local. No reaction.

Systemic. There are chlorotic spots on the young leaves which have wavy margins. The next leaves have a mottle with irregular chlorotic areas which result in malformation.

#### *C. spectabilis*.

Local. No reaction.

Systemic. After a vein clearing and spotting in 13 days, later leaves are rolled and have dark green veinbands.

#### *Dolichos lablab*.

Local. No reaction.

Systemic. There are scattered irregular chlorotic areas.

#### *Glycine javanica*.

Local. Necrotic lesions develop in 8 days.

Systemic. Some leaves have large chlorotic blotches on a puckered surface.

#### *G. max*.

Local. Chlorotic rings develop in 10 days and the leaves drop.

Systemic. There are chlorotic specks and irregular areas which cause a distortion of the leaf surface. The old leaves have necrotic specks.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. The leaves curl down and have chlorotic spots and a dark green midrib.

*Lupinus albus* var. Sweet.

Local. No reaction.

Systemic. The leaves have wavy margins and a chlorotic network. Later ones develop a dark green veinbanding.

*L. albus* var. Bitter.

Local. No reaction.

Systemic. The leaves are small with twisted tips. They have a chlorotic mottle with a necrotic sheen. Many leaves drop and the plant is rosetted.

*L. luteus.*

Local. There are necrotic ringspots.

Systemic. Necrosis may spread rapidly into the growing point which curls to one side, before a total collapse of the plant. If not, the leaves remain folded, with wavy margins, and are mottled and small. The plant is stunted and rosetted.

*L. mutabilis.*

Local. No reaction.

Systemic. The leaves are malformed and stringlike and are chlorotic with dark green marginal blisters. The plant is rosetted.

*Medicago lupulina.*

A symptomless carrier.

*Melilotus officinalis.*

Local. No reaction.

Systemic. After a chlorotic spotting there is a dark green mottle.

*Phaseolus acutifolius.*

Local. In 10 days there are chlorotic spots with necrotic rings and veins.

Systemic. The plant collapses in 12 days after a severe necrosis.

*P. lunatus.*

Local. There are chlorotic spots in 10 days. These fuse to a general chlorosis.

Systemic. Diffuse vein flecks develop.

*P. mungo.*

Local. There are chlorotic spots in 7 days.

Systemic. The young leaves develop chlorotic then necrotic specks and veins in 11 days (Fig. 2c).

*P. vulgaris* var. Canadian Wonder.

Local. There are chlorotic spots in 4 days with a slight necrosis.

Systemic. The young leaves develop a vein clearing in 10 days and later ones have a mottle with dark green blisters.

var. Haricot.

Local. There are chlorotic and necrotic spots, and the leaves drop.

Systemic. Chlorotic spots develop on the young leaves. Later ones are mottled and reduced in size.

*Pisum sativum*.

Local. No reaction.

Systemic. The young leaves develop chlorotic spots and later ones a mottle. The tendrils are abnormally curled.

*Trifolium incarnatum*.

Local. There are chlorotic spots with necrotic rings and veins in 10 days.

Systemic. In 14 days there is a vein clearing followed by a veinbanding or mosaic on most leaves. They are crinkled and the plant is stunted.

*T. pratense*.

Local. No reaction.

Systemic. There are diffuse dark green veinbands.

*Vicia faba*.

Local. There are necrotic lesions in 10 days which fuse and the leaves drop.

Systemic. There is a chlorotic mottle.

*Vigna sesquipedalis*.

Local. Chlorotic spots develop in 10 days.

Systemic. The young leaves develop a vein clearing which may become necrotic. The next leaves are mottled and slightly malformed. (Fig. 2b.).

*V. unguiculata*.

Local. There are necrotic specks and a necrotic sheen in 3 days.

Systemic. The young leaves develop a vein clearing and chlorotic spotting while later ones are mottled with veinbands (Fig. 2d). There may be necrotic stem streaks. The plant is stunted (Fig. 2a).

*Voandzeia subterranea*.

Local. There is a necrotic sheen in 10 days.

Systemic. The young leaves develop a chlorotic spotting and veinbanding, and later leaves are malformed and have a mottle with necrotic specks.

Natural source of virus: *Vigna unguiculata*.

There was a mosaic or dark green veinbanding on the leaves, which were normal in size and shape. On the old leaves there was a slight necrosis in the chlorosis. The plants were not stunted or rosetted.

#### IDENTIFICATION.

Like cowpea mosaic virus A this virus cannot be identified with any of the described cowpea mosaics, nor with the cucumber mosaic strains. It further differs from cowpea mosaic virus A in host range, physical properties and symptoms on many hosts. See tables. Generally, the symptoms caused by the B virus are milder than those caused by the A virus.

This virus is therefore named cowpea mosaic virus B.



### 3. Cucumber Mosaic Virus Strain.

Physical properties: Thermal inactivation point, 62–64°C. Longevity *in vitro*, 4–5 days. Dilution end point, 1: 5000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Dolichos lablab* L., *Glycine max* (L.) Merr., *Lupinus albus* L., vars. sweet and bitter, *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *M. sativa* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. mungo* L., *P. vulgaris* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. medium* L., *T. pratense* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

*Cucumis sativus* L., *Nicotiana glutinosa* L., *N. tabacum* L., *Solanum capsicum* L., *Zinnia elegans* Jacq.

#### REACTION OF SUSCEPTIBLE SPECIES.

*Arachis hypogaea*.

Local. No reaction.

Systemic. There is first a chlorotic spotting and then a mottle on later formed leaves.

*Crotalaria juncea*.

Local. No reaction.

Systemic. Most leaves develop a mottle with dark green islands. They are slightly malformed.

*C. spectabilis*.

Local. Necrotic lesions develop in 7 days.

Systemic. The young leaves show a chlorotic spotting and flecking. Later ones have chlorotic interveinal areas or a diffuse speck mottle.

*Dolichos lablab*.

Local. No reaction.

Systemic. In 3 weeks the older trifoliates show marked chlorotic line patterns and some chlorotic spotting. The young leaves are slightly ruffled and have irregular chlorotic blotches.

*Glycine max*.

Local. There may be a general chlorosis in 4 days.

Systemic. After 11 days there is a vein clearing of the young leaves. Later ones are mottled with dark green blisters and are severely malformed.

*Lupinus albus* var. Sweet.

Local. No reaction.

Systemic. The young leaves remain folded and have wavy margins. Later ones are mottled with dark green blisters and are malformed. The plant is rosetted.

var. Bitter.

Local. No reaction.

Systemic. The leaves become elongated and chlorotic with dark green areas. The plant may collapse.

*L. luteus.*

Local. No reaction.

Systemic. In 3 weeks the young leaves develop small chlorotic spots. Later leaves are very small and rosetted and the plant is very stunted.

*L. mutabilis.*

Local. No reaction.

Systemic. Most leaves are chlorotic with dark green marginal blisters. The plant is stunted and rosetted.

*Medicago lupulina.*

Local. No reaction.

Systemic. Most leaves develop diffuse chlorotic vein slashes.

*M. sativa.*

Local. There are small chlorotic spots.

Systemic. The young leaves show a vein clearing and later leaves may develop small dark green blisters. These are puckered and crinkled.

*Melilotus officinalis.*

Local. No reaction.

Systemic. In 3 weeks the young leaves show chlorotic streaks following the veins. On the old leaves there are occasional chlorotic ringspots.

*Phaseolus acutifolius.*

Local. No reaction.

Systemic. The young leaves show a vein clearing then a mottle with yellow specks.

*P. mungo.*

Local. No reaction.

Systemic. The first trifoliates show a spotting, and later formed leaves have a general chlorosis with slight necrosis. The necrosis may spread until the growing point collapses.

*P. vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. In 13 days there is a mottle followed by vivid yellow spots and vein flecks on the second and third trifoliates (Fig. 3b). The young leaves may be symptomless and when subinoculated there is no virus present.

var. Haricot.

Local. No reaction.

Systemic. The young leaves develop chlorotic spots and then a mottle. Later leaves may be malformed and have yellow areas. The old leaves have large almost white chlorotic blotches.

*Trifolium hybridum.*

Local. No reaction.

Systemic. There are chlorotic streaks.

*T. incarnatum.*

Local. After 2 weeks dark green rings with chlorotic centres appear.

Systemic. The young leaves develop a chlorotic mosaic with necrotic specks and a slight crinkle.

*T. medium.*

Local. No reaction.

Systemic. In 3 weeks there are chlorotic streaks along the veins.

*T. pratense.*

Local. No reaction.

Systemic. There is first a vein clearing and later some veins become necrotic. This leads to a distortion of the leaves. The plant is stunted.

*Vicia faba.*

Local. There are necrotic rings in 6 days.

Systemic. In 11 days chlorotic spots develop on the young leaves and then necrotic specks. Later leaves are mottled with raised dark green areas and necrotic ring and line patterns. The petioles and stem may have superficial necrotic streaks.

*Vigna sesquipedalis.*

Local. In 7 to 8 days there are chlorotic spots with necrotic specks. These leaves drop.

Systemic. In 11 days the young leaves show a vein clearing, and later ones are vividly mottled, and rolled, curled and crinkled (Figs. 3d and f). The symptoms are similar to, but not as severe as, those on *V. unguiculata*.

*V. unguiculata.*

Local. In 4 to 5 days there are chlorotic spots which become necrotic. The leaves bend down and later drop.

Systemic. A week later chlorotic flecks develop on the older trifoliates which may be slightly puckered. Young leaves become progressively more crinkled and also malformed. They are a bright yellow and have dark green blisters and necrotic specks (Fig. 3e). These leaves are small and the plant is stunted and may collapse completely (Fig. 3a).

*Voandzeia subterranea.*

Local. No reaction.

Systemic. After 3 weeks the young leaves develop dark green blisters on a chlorotic background. Later leaves have vivid yellow spots and are curled and contorted.

*Cucumis sativus.*

Local. In 14 days small chlorotic spots develop (Fig. 2g).

Systemic. At the same time the young leaves show a clearing of the veins with dark green blisters. The plant remains stunted (Fig. 2g).

*Nicotiana glutinosa.*

Local. In 4 days necrotic lesions develop.

Systemic. Some leaves have chlorotic ring and line patterns which cause a distortion of the surface (Figs. 2e and f.)

*N. tabacum.*

Local. No reaction.

Systemic. Small chlorotic spots develop in 11 days and on later leaves there are chlorotic ring and line patterns, which distort the leaf surface.

*Solanum capsicum.*

Local. There are necrotic lesions in 4 days and the leaves drop.

Systemic. In 13 days there is a vein clearing followed by a mottle with necrotic specks which cause a malformation of the leaf.

*Zinnia elegans.*

Local. No reaction.

Systemic. After a vein clearing there is a mottle (Fig. 3c).

Natural source of virus: *Vigna unguiculata*.

The leaves had a vivid yellow mottle, and they were puckered and blistered. The plants were severely stunted.

## IDENTIFICATION.

The very marked yellow mottle and severe stunt on cowpea can be compared with only one other virus. Smith & Barker (29) in their report on the bean yellows virus, mention the severe stunt and extreme chlorosis that virus causes on cowpea.

However, the symptoms on the bean are not similar, the host range is very limited and that virus is transmissible by *Empoasca fabalis*.

Apart from this characteristic yellow mottle on cowpea, there are similarities with several of the strains of cucumber mosaic virus, in respect of both physical properties and host range. The host range includes non-leguminous species.

On the cowpea there is some resemblance to the Y strain of Price (21), the yellow isolate of strain 14 of Whipple & Walker (38) and strain C of Fulton (14).

However, Price does not describe the symptoms on other legume hosts, so a comparison can not be made.

Both the Y isolate of strain 14 and strain C cause systemic necrosis and ultimate collapse of beans and peas, while this virus either induces a yellow fleck on beans or is latent; and it is unable to infect peas.

Whipple & Walker report that their strain 17, the celery virus 1 strain and the type cucumber mosaic virus all result in local lesions on cowpea, and systemic necrosis on pea. They are unable to infect beans. Peas are susceptible to all the other strains described by Fulton.



Harter's lima bean mosaic (16), also considered a strain of cucumber mosaic virus, causes only local lesions on cowpea, and is non-infectious to bean, lupin, soybean, alsike etc., all of which are hosts of this virus.

The strain of cucumber mosaic virus described by Anderson (3a), may cause both local and systemic symptoms on cowpeas, but on most varieties they are masked—in contrast to the severe effect of this virus. Furthermore the symptoms of Anderson's strain on tobacco and cucumber are transient only, whereas with this virus they are definite and lasting. Anderson's strain withstands only 6–24 hours ageing, and this one lasts 4–5 days.

To sum up—although this virus shows many links with the cucumber mosaic virus group, it can not be fully identified with any of the strains already described. It is therefore considered a new strain of the cucumber mosaic virus.

#### COMPARISON OF SYMPTOMS CAUSED BY COWPEA MOSAIC VIRUSES A AND B ON SOME HOST PLANTS.

Host Plant.	Cowpea Mosaic Virus A.	Cowpea Mosaic Virus B.
1. <i>Crotalaria juncea</i> .....	Local—necr. specks and chl. O. Syst.—mot., dgr. blisters and veinb., necr. specks.	Local—no reaction. Syst.—irreg. chl. areas, malformation.
2. <i>Lupinus albus</i> .....	Local—dark green spots. Syst.—chl. sp., necr. specks, collapse.	Local—no reaction. Syst.—chl. network, dgr. veinbands.
3. <i>Melilotus officinalis</i> .....	Symptomless carrier.	Local—no reaction. Syst.—dgr. mottle.
4. <i>Phaseolus acutifolius</i> ....	Local—chl. spots. Syst.—speck mottle.	Local—chl. spots, necr. O and veins. Syst.—necrosis and collapse.
5. <i>Trifolium incarnatum</i> ....	Local—necr. spots and veins. Syst.—chl. streaks, mosaic, necr., crinkle, ros., collapse.	Local—chl. spots, necr. O and veins. Syst.—mosaic, crinkle.
6. <i>Vigna sesquipedalis</i> .....	Local—chl. spots. Syst.—mot., dgr. veinbands, necrosis, malformation.	Local—chl. spots. Syst.—mottle.
7. <i>Vigna unguiculata</i> .....	Local—reflex., necr. sp. and veins. Syst.—mosaic, necr. specks, malformation, necr. stem streaks.	Local—necr. sheen. Syst.—mottle, dark green veinbands.

#### ABBREVIATIONS USED:—

chl.—chlorosis/chlorotic.  
dgr.—dark green.  
irreg.—irregular.  
mot.—mottle.  
necr.—necrosis/necrotic.

ros.—rosette.  
sp.—spots.  
veinb.—veinbands.  
O—rings.

#### COMPARISON OF PHYSICAL PROPERTIES AND METHODS OF TRANSMISSION.

Virus.	Thermal inactivation point.	Longevity in vitro.	Dilution end point.	Transmission.		
				Sap.	Seed.	Aphid.
Cowpea mosaic virus A.....	62–65°C	2–4 days	1 : 2000	+	—	+
Cowpea mosaic virus B.....	60–62°C	2–3 days	1 : 1000	+	—	?
Cucumber mosaic virus strain	62–64°C	4–5 days	1 : 5000	+	—	+

## HOST RANGES.

	Cowpea Mosaic Virus A.	Cowpea Mosaic Virus B.	Cucumber Mosaic Virus Strain.
<i>Arachis hypogaea</i> .....	+	—	+
<i>Crotalaria juncea</i> .....	+	+	+
<i>C. spectabilis</i> .....	+	+	+
<i>Dolichos lablab</i> .....	+	+	+
<i>Glycine javanica</i> .....	+	+	
<i>G. max</i> .....	+	+	+
<i>Lathyrus odoratus</i> .....	+	+	—
<i>Lupinus albus</i> —sweet.....	+	+	+
<i>Lupinus albus</i> —bitter.....	+	+	+
<i>L. luteus</i> .....	+	+	+
<i>L. mutabilis</i> .....	+	+	+
<i>Medicago lupulina</i> .....	+	+	+
<i>M. sativa</i> .....	+	—	+
<i>Melilotus officinalis</i> .....	+	+	+
<i>Phaseolus acutifolius</i> .....	+	+	+
<i>P. lunatus</i> .....	+	+	
<i>P. mungo</i> .....	+	+	+
<i>P. vulgaris</i> .....	+	+	—
<i>Pisum sativum</i> .....	+	+	+
<i>Trifolium fragiferum</i> .....	+	—	—
<i>T. hybridum</i> .....	+	—	+
<i>T. incarnatum</i> .....	+	+	+
<i>T. pratense</i> .....	+	—	+
<i>T. repens</i> .....	+	+	—
<i>Vicia faba</i> .....	+	+	+
<i>Vigna sesquipedalis</i> .....	+	+	+
<i>V. unguiculata</i> .....	+	+	+
<i>Voandzeia subterranea</i> .....	+	+	+
<i>Cucumis sativus</i> .....	—	—	+
<i>Nicotiana glutinosa</i> .....	—	—	+
<i>N. tabacum</i> .....	—	—	+
<i>Solanum capsicum</i> .....	—	—	+
<i>Zinnia elegans</i> .....	—	—	+

## SUMMARY.

Three virus diseases of naturally infected cowpeas are described in detail—their physical properties, methods of transmission, host ranges and symptoms. None could be fully identified with any previously recorded virus or strain.

1. Cowpea mosaic virus A. In the field the plants are stunted and the leaves are small and malformed. They have dark green veinbands or a mosaic with necrosis. The virus is inactivated at temperatures of 62–65°C., at a dilution of 1:2,000 and after 2–4 days ageing *in vitro*. It is sap and aphid transmissible and the host range is confined to the *Leguminosae*.

2. Cowpea mosaic virus B. The only symptom in the field is a dark green veinbanding. The thermal inactivation point of the virus is 60–62°C. The longevity *in vitro* is 2–3 days and the dilution end point, 1: 1,000. It is sap transmissible, but results from insect transmissions were inconclusive. The host range is confined to the legumes, and the symptoms are generally milder than for the A virus.

3. Cucumber mosaic virus strain. The field symptoms are severe—the plants are very stunted and the leaves show a vivid yellow mottle. Similarities in physical properties, host range (which includes the non-legumes) and symptoms, indicate a relationship with the cucumber mosaic virus group.

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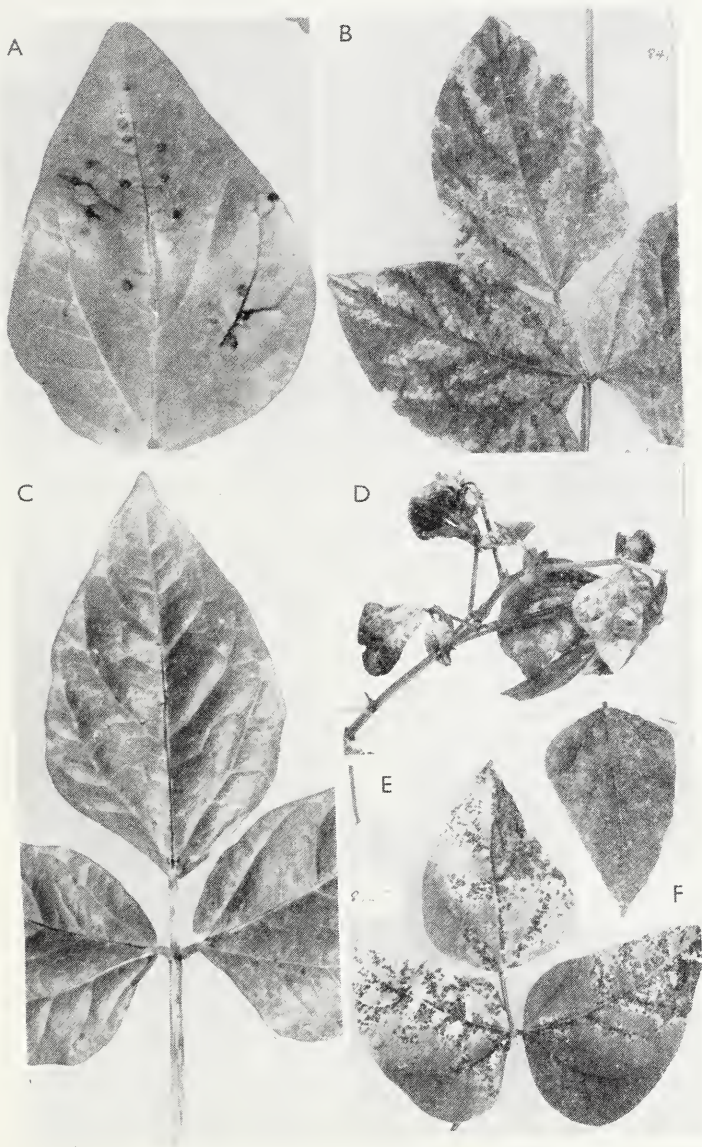


FIG. 1.—COWPEA MOSAIC VIRUS A.

A-D *Vigna unguiculata*. A. Local necrotic lesions. B. Systemic veinbanding and mosaic. C. Systemic necrotic specks. D. Malformation of young leaves.

E-F *Phaseolus lunatus*. E. Necrosis and chlorosis on older leaf. F. Fine chlorotic network on young leaf.

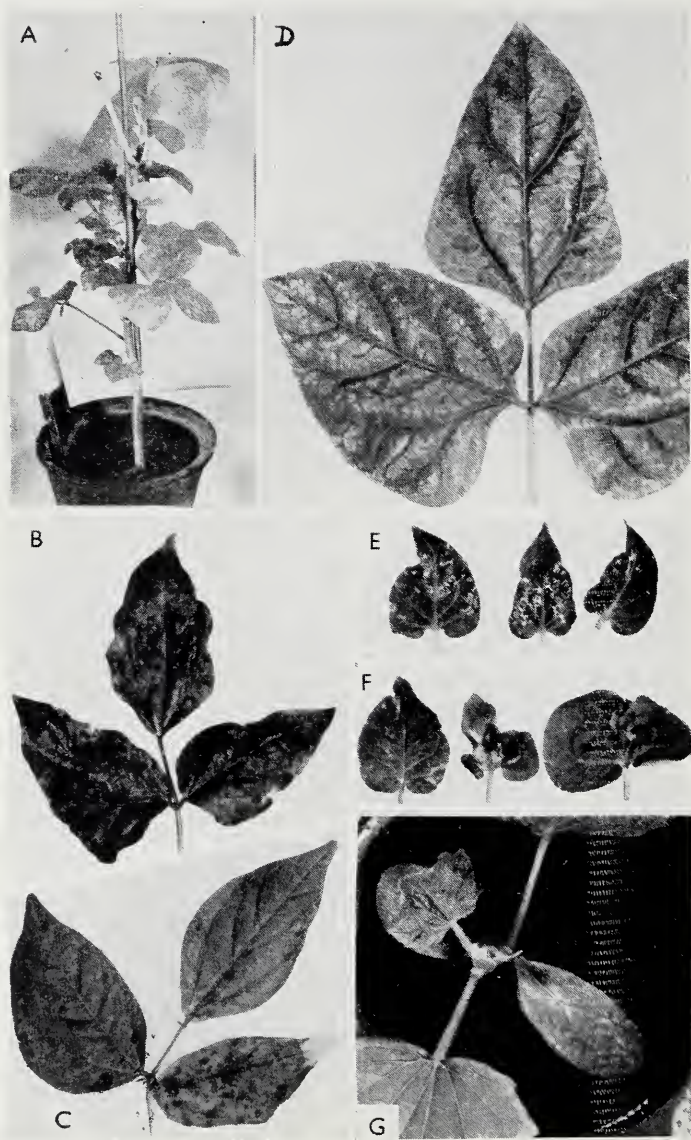


FIG. 2.—A-D COWPEA MOSAIC VIRUS B.  
 A and D *Vigna unguiculata*. B. *V. sesquipedalis*. C. *Phaseolus mungo*.  
 E-G CUCUMBER MOSAIC VIRUS STRAIN.  
 E and F *Nicotiana glutinosa*. G. *Cucumis sativus*.

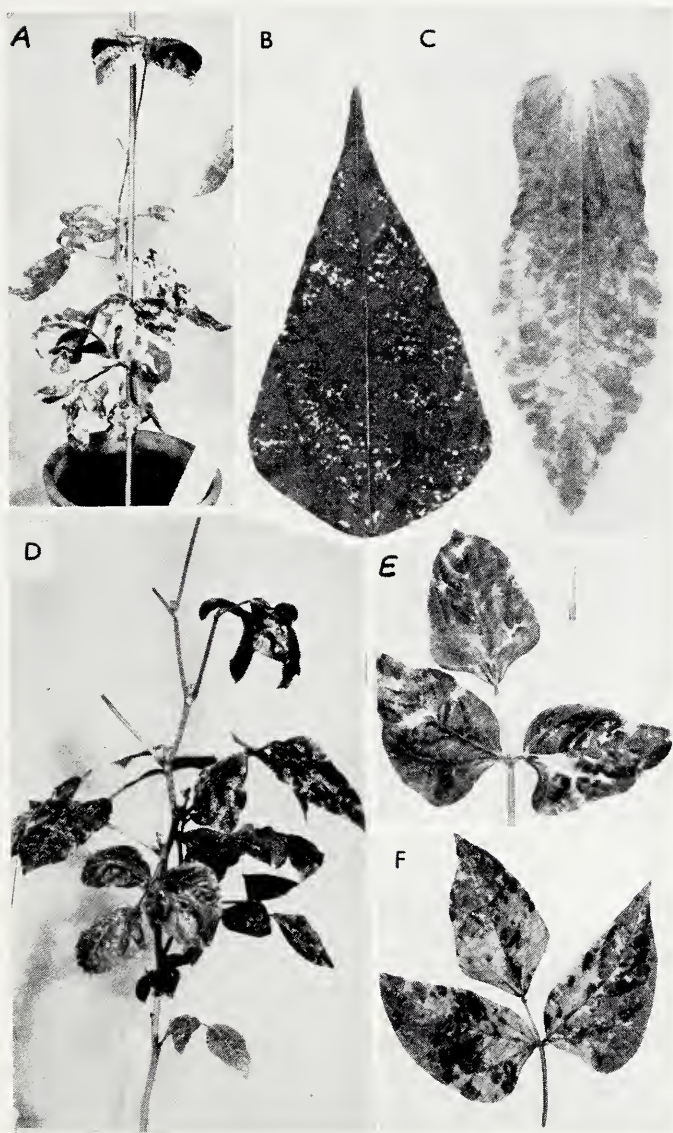


FIG. 3.—CUCUMBER MOSAIC VIRUS STRAIN.

A and E. *Vigna unguiculata*. D and F. *V. sesquipedalis*. B. *Phaseolus vulgaris*. C. *Zinnia elegans*.





## Virus Diseases of Peas and Sweet Peas.

By

Patricia J. Klesser.

According to the Revised List of Plant Diseases occurring in South Africa (3), the only virus disease of peas and sweet peas that has been positively identified, is the one caused by the tomato spotted wilt virus.

Other disorders due to virus infections have long been recognised but the causal organisms were not determined.

This report concerns eight viruses which occur naturally on *Pisum sativum* and *Lathyrus odoratus* in South Africa.

Apart from tomato spotted wilt there are three other diseases which are commonly found on both peas and sweet peas, viz. pea mosaic, pea stunt and a strain of lucerne mosaic.

Further, peas are naturally infected by pea virus 2, pea mosaic virus 4, and a strain of pea wilt virus. Sweet peas are also susceptible in the field to bean local chlorosis virus B and a strain of bean yellow mosaic.

Although pea mosaic, pea virus 2 and pea stunt are well-known elsewhere, they are reported for the first time in South Africa. (Pea mosaic virus 4 was discussed in detail in the paper on lupin virus diseases, as it occurs frequently on *Lupinus* species.)

Details of what appear to be new strains of the pea wilt, lucerne mosaic and bean yellow mosaic viruses are given, and a virus causing vivid local chlorotic spots on bean is described.

Pea mosaic has long been recognised as the primary virus disease of peas, but in this country more damage is caused by the tomato spotted wilt virus. This occurs frequently, and results in a systemic necrosis and possible collapse of the plants.

The other viruses are found spasmodically but the effect on individual plants can be severe. The necrotic ring strain of the lucerne mosaic virus also induces a systemic necrosis and collapse of the plant, while the pea stunt and pea wilt viruses cause necrotic stem streaks with a mosaic.

With the pea mosaic virus and pea virus 2 there is only a mosaic or mottle.

On the sweet pea, chlorotic spots, veinbands or a mosaic, may develop on the leaves of plants infected with the pea mosaic virus, or strains of the bean yellow mosaic and bean local chlorosis viruses.

Systemic necrosis occurs when the spotted wilt virus, pea stunt virus or a strain of lucerne mosaic virus are present.

Most of these viruses can cause a colour break on the flowers.

## METHODS AND MATERIALS.

The standard test plants used were: *Phaseolus vulgaris* var. Canadian Wonder, *Vicia faba* var. Aquadulce and *Pisum sativum* var. Greenfeast. In addition about 30 other legumes and some plants belonging to the *Solanaceae* were used in susceptibility tests.

*Aphis craccivora* or *Macrosiphum pisi* were used for the insect transmission tests, although they are not necessarily the natural vectors. Carborundum powder was used for the sap inoculations.

In this report eight virus diseases are described—their physical properties, methods of transmission, host ranges and symptoms on susceptible hosts.

Their identification is based on information from the literature, but when no complete correlation can be found, new names are provisionally proposed.

## 1. Pea Mosaic Virus Doolittle &amp; Jones.

Physical properties: Thermal inactivation point, 56–58°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1: 1,000–1: 2,000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Crotalaria juncea* L., *Glycine javanica* L., *Lathyrus odoratus* L., *Lens esculentum* L., *Lupinus albus* L., *L. luteus* L., *Medicago lupulina* L., *Melilotus officinalis* Willd., *Phaseolus mungo* L., *P. vulgaris* L., (?) *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L.

## REACTION OF SUSCEPTIBLE SPECIES.

*Crotalaria juncea*.

Local. Necrotic rings can be seen after 6 days. These fuse and the leaf drops.

Systemic. The young leaves develop chlorotic spots with necrotic centres. This necrosis spreads until the leaf is “scorched” and eventually drops. Due to streak necrosis, the stem curves at the top, and the plant soon dies.

*Glycine javanica*.

A symptomless carrier.

*Lathyrus odoratus*.

Local. No reaction.

Systemic. The leaves develop chlorotic spots and later a mosaic. They are rolled and reduced in size. The flowers have a marked colour break (Fig. 1c).

*Lens esculentum*.

Local. No reaction.

Systemic. In about 11 days the young leaves show chlorotic spots or streaks. Later necrosis may set in, in these areas and the plant collapses. If necrosis is not present the leaves are tightly curled and the stems are rosetted, with a general stunt of the plant.

*Lupinus albus.*

Local. In 6 days there are small chlorotic spots with necrotic centres.

Systemic. In 14 days the veins of the young leaves become necrotic and the leaflets drop. Later formed leaves are firstly chlorotic but soon become necrotic. The growing point is stunted and almost completely defoliated. The stem becomes necrotic and the plant collapses. The stem necrosis occurs in streaks on one side only, resulting in a curved stem (Fig. 1d).

*L. luteus.*

Local. No reaction.

Systemic. The young leaves remain folded and have wavy margins. They are mottled. The plant is stunted and no flowers are formed.

*Medicago lupulina.*

A symptomless carrier.

*Melilotus officinalis.*

Local. No reaction.

Systemic. Chlorotic vein slashes develop in one month.

*Phaseolus mungo.*

Local. The veins become necrotic and the leaves collapse.

Systemic. The young leaves curl down and their veins become necrotic, with the interveinal areas quite chlorotic. A stem necrosis may develop and the plant then collapses.

*P. vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. Occasionally the first trifoliate develops large chlorotic blotches. The young leaves may have a chlorotic network.

var. Haricot.

Local. No reaction.

Systemic. The leaves may be mottled with a slight malformation.

*Pisum sativum.*

Local. No reaction.

Systemic. In 7 days there is a clearing of the veins of the young leaves with small chlorotic flecks. A week later this is followed by a mosaic mottle of the youngest leaves, (Fig. 1a) but there may also be dark green veinbands or irregular chlorotic slashes. The leaves remain slightly folded, and are puckered and reduced in size. The growing point is rosetted and the tendrils abnormally curled.

*Trifolium hybridum.*

Local. No reaction.

Systemic. After a vein clearing the leaves show a chlorotic streaking.

*T. incarnatum.*

Local. No reaction.

Systemic. The young leaves develop a clearing of the veins in 7 days. Later formed leaves may show a chlorotic spot mottling, veinbanding or a characteristic chlorotic triangle at the apex. These leaves are crinkled and rolled and the plant is stunted (Fig. 1b).

*T. pratense.*

A symptomless carrier.

*T. repens.*

A symptomless carrier.

*Vicia faba.*

Local. No reaction.

Systemic. After 7 days a diffuse mottle develops on the young leaves. A week later the young leaves show a mosaic, and they are rolled and reduced in size.

Natural source of virus: *Pisum sativum* (Pretoria and district). The older leaves were flecked and mottled and the younger ones had a mosaic mottle. The plants were rosetted and the tendrils were abnormally curled.

*Lathyrus odoratus* (Pretoria). The leaves had a chlorotic streak mottle and there was a marked colour break on the flowers.

#### IDENTIFICATION.

From the symptom expression, host range and physical properties, there can be little doubt that this is the pea mosaic virus.

### 2. Pea Virus 2 Osborn.

Physical properties: Thermal inactivation point, 60–62°C. Longevity *in vitro*, 3–4 days. Dilution end point, 1: 2,000.

Transmission: Mechanical sap inoculation. *Macrosiphum pisi*.

Host range: *Lathyrus odoratus* L., *Lupinus albus* L., *Medicago lupulina* L., *Phaseolus vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. pratense* L., *Vicia faba* L.

#### REACTION OF SUSCEPTIBLE SPECIES.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. In 14 days the leaves show a mosaic mottle with chlorotic streaks. These leaves are slightly curled downwards.

*Lupinus albus.*

Local. In 9 days there are large necrotic lesions which fuse, and the leaflets drop.

Systemic. 3 to 4 days later the necrosis extends up the stem and into the growing point, and the plant collapses (Fig. 2d).

*Medicago lupulina.*

Local. No reaction.

Systemic. Only a fine chlorotic network of the younger leaves develops.

*Phaseolus vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. In a week chlorotic spots appear on the young leaves. The second and third trifoliates develop chlorotic flecks, and later formed leaves show only irregular chlorotic areas. These leaves have slightly uneven surfaces (Fig. 2b). The plant is stunted and rosetted, with pods blistered in dark green.



*Pisum sativum.*

Local. The inoculated leaves wither and drop.

Systemic. In a week the young leaves develop a vein clearing and chlorotic spotting. Later leaves show a mosaic with dark green veinbands and they are curled upwards. The plant is rosetted and stunted, and the tendrils are abnormally curled (Fig. 2a).

*Trifolium hybridum.*

Local. No reaction.

Systemic. There are alternate chlorotic and green streaks following the veins of the leaves.

*T. pratense.*

Local. No reaction.

Systemic. Diffuse chlorotic vein slashes develop in one month.

*Vicia faba.*

Local. No reaction.

Systemic. In 7 days there is a clearing of the veins of the young leaves followed by a chlorotic spotting. Later leaves have a mosaic in which the dark green areas are raised (Fig. 2c.) There may also be concentric chlorotic patterns on these leaves.

Natural source of virus: *Pisum sativum* (Pretoria and district). The plants were rosetted and the leaves showed a chlorotic flecking and mosaic mottle.

## IDENTIFICATION.

This virus is similar to the pea mosaic virus of Doolittle & Jones (4) in many respects, but it regularly causes a systemic reaction on the bean.

The pea virus 2 Osborn (10), shows this ability to infect certain varieties of bean; and therefore this virus appears to be identical with or closely related to it.

## 3. Pea Stunt Virus Zaumeyer.

Physical properties: Thermal inactivation point, 60–62°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1: 5,000–1: 10,000.

Transmission: Mechanical sap inoculation.

Host range: *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *Medicago sativa* L., *Phaseolus vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

## REACTION OF SUSCEPTIBLE SPECIES.

*Crotalaria juncea.*

Local. Some necrosis may occur.

Systemic. After 17 days there are dark green veinbands and a speck mottle. The leaves are small, rolled and rosetted, and the plant is stunted.

*C. spectabilis.*

Local. No reaction.

Systemic. The young leaves show chlorotic veins and spots in 7 days. Later leaves are malformed and crinkled, with irregular chlorosis. The plant is stunted.

*Glycine max.*

Local. The leaves become chlorotic and drop.

Systemic. After a chlorotic spotting the leaves develop a mottle with some yellow specks. The old leaves have a chlorotic network.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. After 2 weeks many leaves show dark green veinbands or a mottle. They are rolled and slightly puckered.

*Lupinus albus.*

Local. There are necrotic specks with chlorotic halos.

Systemic. The young leaves have necrotic specks and veins, and soon drop. The next leaves are chlorotic with dark green blisters, and they are rolled and crinkled. There are necrotic stem streaks and the plant is stunted.

*L. luteus.*

Local. No reaction.

Systemic. The young leaves remain folded and in 9 days there is a vein clearing. Later ones are mottled, elongated and crinkled with wavy margins. The plant is stunted and rosetted.

*Medicago sativa.*

Local. No reaction.

Systemic. There is a chlorotic network followed by a chlorotic flecking on some leaves.

*Phaseolus vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. In 6 to 8 days the young leaves show a vein clearing while the first and second trifoliates develop chlorotic blotches, spots, or vein flecks. Later leaves are mottled and rolled with a slight puckering (Fig. 3b). The pods are blistered (Fig. 3c) and the plant is stunted.

var. Haricot.

Local. No reaction.

Systemic. The young leaves may drop after a veinal necrosis. The next formed leaves are small and malformed with a chlorotic mottle.

*Pisum sativum.*

Local. No reaction.

Systemic. The young leaves develop chlorotic veins in 6 days, and then spots. Later leaves have a mosaic, and they are malformed and reduced in size. The tendrils are abnormally curled (Fig. 3a). Later leaves have necrosis in the chlorosis and there are necrotic stem streaks. The pods have purple lesions.

*Trifolium hybridum.*

Local. No reaction.

Systemic. After 16 days the leaves show chlorotic veins, spots and streaks, and they may be slightly crinkled.

*T. incarnatum.*

Local. No reaction.

Systemic. There is a chlorotic network on the young leaves. Later ones have dark green veinbands or a mosaic, and they are crinkled. The old leaves may have necrotic specks.

*Vicia faba.*

Local. No reaction.

Systemic. After 7 days there are chlorotic spots on the young leaves. Later leaves have dark green veinbands or a mosaic; they are long and narrow and rolled (Fig. 3d).

*Vigna sesquipedalis.*

A symptomless carrier.

*V. unguiculata.*

A symptomless carrier.

*Voandzeia subterranea.*

A symptomless carrier.

Natural source of virus: *Lathyrus odoratus* (Pretoria and district). Most leaves had a chlorotic mottle, and there were necrotic stem streaks. The flowers showed a marked colour break. *Pisum sativum* (Pretoria and district). The leaves had irregular chlorotic areas with varying amounts of necrosis. There were also necrotic stem streaks and the plants were stunted.

## IDENTIFICATION.

This virus shows most similarity with the stunt virus of Zaumeyer (17), both in respect of symptomology and physical properties. Although not identical, it is considered closely related to the pea stunt virus.

## 4. Pea Wilt Virus—New Strain.

Physical properties: Thermal inactivation point, 58–60°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1: 10,000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Dolichos lablab* L., *Glycine javanica* L., *G. max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *Medicago lupulina* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

## REACTION OF SUSCEPTIBLE SPECIES.

*Arachis hypogaea.*

Local. No reaction.

Systemic. Some leaves have a chlorotic mottle with patterns and the older ones have chlorotic blotches.

*Crotalaria juncea.*

Local. No reaction.

Systemic. In 15 days the growing point becomes stunted and may bend over. The leaves are uniformly chlorotic with only isolated dark green areas. Later formed leaves are chlorotic with dark green blisters and veinbands. They have crinkled surfaces and are slightly malformed. The plant is stunted.

*C. spectabilis.*

Local. There are necrotic lesions in 7 days.

Systemic. After a chlorotic vein flecking of the young leaves, later ones are chlorotic with dark green specks. These leaves are crinkled and the plant is stunted.

*Dolichos lablab.*

A symptomless carrier.

*Glycine javanica.*

A symptomless carrier.

*G. max.*

Local. There are chlorotic spots which later have a necrotic ring. There is also some veinal necrosis.

Systemic. In 9 days the young leaves show a clearing of the veins. This becomes a dark green mottle on the next formed leaves, which are also puckered. The older leaves may have small necrotic spots.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. The leaves remain folded and they are chlorotic with dark green islands, and slightly malformed. Some plants collapsed from necrosis.

*Ujirus albus.*

Local. Small chlorotic spots appear in 9 days and the leaflets drop later.

Systemic. The young leaves have a chlorotic network and the leaflets remain folded and have wavy margins. There may be stem necrosis. There is little upward growth so that the growing point becomes stunted and rosetted with many small string-like leaves. These are chlorotic with dark green marginal blisters. No flowers are formed.

*L. luteus.*

Local. No reaction.

Systemic. In 13 days the young leaves show chlorotic spots and they remain folded. Later leaves are mottled or have dark green blisters on malformed, stringlike leaves. The plant is stunted and rosetted.

*Medicago lupulina.*

Local. No reaction.

Systemic. A diffuse chlorotic mottle develops.

*Melilotus officinalis.*

Local. No reaction.

Systemic. After a vein clearing of the young leaves, there are chlorotic spots or streaks on later formed leaves.



*Phaseolus acutifolius.*

Local. In 4 days the veins are necrotic and later chlorotic spots develop.

Systemic. After 10 to 11 days, the young leaves show a vein clearing and later a mottle. There may be some malformation. New leaves have almost yellow specks.

*P. lunatus.*

Local. Chlorotic veins and irregular areas develop in 7 to 9 days.

Systemic. In 9 days there is a vein clearing of the young leaves. Later ones have a diffuse mottle, veinbanding or flecking.

*P. mungo.*

Local. No reaction.

Systemic. There is a diffuse chlorotic speckling after 2 weeks. On the old leaves there is also necrosis.

*P. vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. After 9 days the first trifoliates show large chlorotic star flecks. The young leaves have a vein clearing and later ones a spot mottle with the dark green along the veins (Fig. 4d).

## var. Haricot.

Local. The veins are slightly necrotic and later small chlorotic spots with necrotic halos appear.

Systemic. There is a chlorosis with dark green blisters, and malformation and twisting of the leaves. There is only a slight necrosis.

*Pisum sativum.*

Local. The inoculated leaves collapse.

Systemic. There is a vein clearing in 2 weeks, followed by a chlorotic mottling of the leaves which remain slightly folded. The plant is rosetted and stunted (Fig. 4a). The stem may have necrotic streaks and the tendrils are abnormally curled.

*Trifolium hybridum.*

Local. No reaction.

Systemic. In 24 days there is a clearing of the veins of the young leaves, and thereafter, alternate streaks of yellow and green develop on later formed leaves.

*T. incarnatum.*

Local. There are necrotic specks in 7 to 8 days.

Systemic. The young leaves develop a vein clearing. Later ones have dark green veinbands and they are puckered and crinkled.

*T. pratense.*

Local. No reaction.

Systemic. There are occasional chlorotic vein streaks which become necrotic and result in a malformation of the leaf surface (Fig. 4c).

*Vicia faba.*

Local. The leaves develop dark green or necrotic rings. They become flaccid and drop (Fig. 4b).

Systemic. No reaction, but the virus is present.

*Vigna sesquipedalis.*

Local. Within a week chlorotic spots appear.

Systemic. In 21 days the young leaves show chlorotic spots, and later ones a mottle and malformation.

*V. unguiculata.*

Local. There are necrotic specks with chlorotic halos.

Systemic. In 2 weeks there is a vein clearing followed by a diffuse chlorotic mottle.

*Voandzeia subterranea.*

Local. No reaction.

Systemic. There are chlorotic specks and dark green veinbands.

Natural source of virus: *Pisum sativum* (Pretoria). The plants were stunted and unthrifty and the leaves had a very diffuse mottle. *Phaseolus vulgaris* (Pretoria and district). On the variety Black Wonder the younger leaves had vivid chlorotic spots and the older ones a dark green veinbanding and mottle. The plants were stunted.

## IDENTIFICATION.

On the major host plants e.g. pea, cowpea, bean and broad bean, the symptoms produced by this virus are very similar to those caused by the pea wilt virus Johnson (8). But on other plants there are small differences and the physical properties differ in the longevity and dilution end points.

Nevertheless, this virus is grouped with it as a possible strain, and is named pea wilt virus, strain A.

## 5. Lucerne Mosaic Virus—Necrotic Ring Strain.

Physical properties: Thermal inactivation point, 62–65°C. Longevity *in vitro*, 7–8 days. Dilution end point, 1: 3,000–1: 5,000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *Vicia faba* L., *Vigna unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

## REACTION OF SUSCEPTIBLE SPECIES.

*Crotalaria juncea.*

Local. In 6 days there are necrotic lesions.

Systemic. The young leaves show chlorotic spots which soon become necrotic and cause a malformation of the leaves. The plant is stunted.

*C. spectabilis.*

Local. There are dark green rings with necrosis.

Systemic. The young leaves show chlorotic spots and later leaves have chlorotic ring and line patterns and are crinkled. There may be a slight malformation and dark green blisters.

*Glycine max.*

Local. No reaction.

Systemic. After a chlorotic spotting of the young leaves, later ones develop a mottle. They are slightly crinkled.

*Lathyrus odoratus.*

Local. Small chlorotic spots develop which later become necrotic.

Systemic. In 3 weeks the stem has become necrotic and the plant collapses.

*Lupinus albus.*

Local. No reaction.

Systemic. The young leaves develop chlorotic spots. Later ones are crinkled and rolled with chlorotic veinbands.

*L. luteus.*

Local. No reaction.

Systemic. The young leaves remain folded and have chlorotic spots. Later ones are crinkled or malformed, with an irregular chlorotic mottle. The plant is rosetted and stunted.

*Melilotus officinalis.*

Local. No reaction.

Systemic. There are chlorotic areas and a slight distortion.

*Phaseolus acutifolius.*

Local. No reaction.

Systemic. In 15 days there is a vein clearing, followed by a mottle with slight necrosis.

*P. vulgaris* var. Canadian Wonder.

Local. Within 5 days there are small chlorotic spots which later have a halo. Severe necrosis sets in, in the chlorosis (Fig. 5c).

Systemic. No reaction.

var. Haricot.

Local. In a week there are necrotic ringspots and veins.

Systemic. On some plants the young leaves show severe rolling and curling down. There are small chlorotic spots with necrotic veins and specks which spread until the plant collapses (Fig. 5d).

vars. Black Wonder, Idaho Refugee and Long Tom develop only local chlorotic rings or irregular areas in 3 to 6 days.

vars. S.A. Black and White and Tendergreen have no local reaction and only a transient vein clearing or spotting.

*Pisum sativum.*

Local. There may be necrotic rings and spots which cause the leaves to collapse.

Systemic. In 11 to 12 days the young leaves show a vein clearing or chlorotic flecks which soon become necrotic. This necrosis progresses down the stem and the growing point collapses. Secondary shoots may develop and these have malformed twisted and rosetted leaves with irregular chlorotic areas. The tendrils are abnormally curled (Fig. 5a).

*Trifolium hybridum.*

Local. No reaction.

Systemic. After 12 days there are chlorotic spots on the young leaves and later formed ones develop a streak mottle.

*T. incarnatum.*

Local. The leaves may collapse.

Systemic. In 12 days a vein clearing develops on the young leaves. Later leaves show a mosaic mottle and are crinkled and malformed. The plant is stunted.

*Vicia faba.*

Local. In 4 to 5 days large chocolate-coloured necrotic lesions develop. The leaves become flaccid (Fig. 5b).

Systemic. A week later small chlorotic spots or a vein clearing may occur on the young leaves. Usually the necrosis spreads quickly up the stem and into the growing point and the plant collapses.

*Vigna unguiculata.*

Local. In 5 days the leaves develop chlorotic spots with necrotic rings and veins. These soon drop.

Systemic. Only occasionally are there similar symptoms on the trifoliates, which collapse. If symptomless the virus can be recovered.

*Voandzeia subterranea.*

Local. No reaction.

Systemic. The young leaves develop a chlorotic spotting.

Natural source of virus: *Pisum sativum* (Northern Transvaal). The young leaves were mottled, the stems were necrotic and the growing points flaccid. The plants were stunted and rosetted and the tendrils abnormally curled.

*Lathyrus odoratus* (Pretoria and district). The leaves had a vein-clearing, chlorotic spotting or veinbanding, with necrosis setting in. Some plants collapsed after this necrosis, while others produced secondary shoots with malformed, blistered leaves. Flowers on these stems showed a marked colour break.

## IDENTIFICATION.

Several viruses show similar reactions on the pea, but cannot be considered the same as the above for the following reasons: Both pea American streak virus Zaumeyer (16) and Wisconsin pea stunt virus Hagedorn & Walker (5) are unable to infect the *Phaseolus* spp. which are hosts of this virus.

Pea Wisconsin streak virus Hagedorn & Walker (6) does not infect *Vicia faba*, whereas this virus causes severe necrosis.



The pea stunt virus Zaumeyer (17) and the pea stunt virus strain Klesser (9) induce only a systemic reaction on the bean, while in addition the latter causes only a systemic chlorosis on the broad bean.

Pea New Zealand streak virus Chamberlain (2) infects several non-legumes, induces different symptoms on many hosts and has different physical properties.

On the bean the symptoms are very like those caused by the lucerne mosaic virus, Weimer (15). Physical properties and legume host range are also similar, although lucerne mosaic virus is able to infect the non-legumes.

On pea and broad bean the symptoms resemble those of Zaumeyer's alfalfa mosaic viruses 1A and 1B (16), but neither of these induces a lethal necrosis of the sweet pea. Further, there is a considerable discrepancy in physical property values.

Apart from the necrotic reaction on the sweet pea this virus is almost identical with, and can be considered the same as the lucerne mosaic virus necrotic ring strain Klesser.

#### 6. Bean Local Chlorosis Virus—Strain B.

Physical properties: Thermal inactivation point, 58–60°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1: 1,000–1: 2,000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Crotalaria spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *Phaseolus vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *Vicia faba* L., *Vigna unguiculata* (L.) Walp.

#### REACTION OF SUSCEPTIBLE SPECIES.

*Crotalaria spectabilis*.

Local. No reaction.

Systemic. After 7 days the young leaves show a vein clearing and spotting. Later leaves have irregular, almost white, streaks which lead to malformation of the leaf surface (Fig. 6c).

*Glycine max*.

Local. No reaction.

Systemic. A diffuse chlorotic mottle develops on most leaves.

*Lathyrus odoratus*.

Local. No reaction.

Systemic. After 11 days the young leaves show chlorotic streaks. This continues on later leaves or there is a mosaic. Necrotic streaks may occur on the stem and petioles. (Fig. 6f). There is a colour break on the flowers (Fig. 6e).

*Lupinus albus*.

Local. No reaction.

Systemic. After a vein clearing and spotting of the young leaves the next formed are crinkled with dark green blisters. There may be small necrotic speckles.

*L. luteus*.

Local. No reaction.

Systemic. Most leaves remain folded and have small chlorotic spots.

*Phaseolus vulgaris* var. Canadian Wonder.

Local. In 5 days vivid chlorotic spots appear (Fig. 6a).

Systemic. Shortly afterwards the young leaves also develop chlorotic spots and vein flecks (Fig. 6d). Later leaves are malformed and mottled (Fig. 6b). The old leaves show large chlorotic blotches.

*Pisum sativum*.

Local. No reaction.

Systemic. In 6 days there is a vein clearing and spotting of the young leaves. Later leaves are small and malformed with irregular dark green areas. The plant is rosetted and stunted and the tendrils are abnormally curled. There are necrotic stem streaks.

*Trifolium hybridum*.

Local. Small chlorotic spots develop.

Systemic. Most leaves have a chlorotic streak mosaic.

*T. incarnatum*.

Local. No reaction.

Systemic. In 16 days there is a vein clearing. Later leaves have a mosaic and are slightly malformed.

*Vicia faba*.

Local. No reaction.

Systemic. Chlorotic spots develop on the young leaves in a week. The next leaves all have a mosaic.

*Vigna unguiculata*.

Local. Small red necrotic lesions appear in 5 days.

Systemic. No reaction.

Natural source of virus: *Lathyrus odoratus* (Pretoria district). The leaves had chlorotic veinbands or streaks, and they were small and puckered.

#### IDENTIFICATION.

The vivid chlorotic spotting on the inoculated leaves of the bean is a characteristic feature of a group of viruses recorded in England by the writer.

The only published reports of similar viruses are those by Ainsworth and Zaumeyer.

Ainsworth (1) isolated a virus which caused a "sweet pea streak" and which induced a local chlorotic spotting on the bean. However, necrotic rings developed later on these leaves and the plant collapsed from a systemic necrosis, whereas this virus causes no necrosis on the bean.

On other plants there are also differences—on broad bean and sweet pea Ainsworth's virus resulted in a systemic necrosis whereas this virus induces a mottle or mosaic.

Zaumeyer's alfalfa yellow mosaic virus (18) causes symptoms on some varieties of bean which are very similar to those described for this virus, but on other varieties there is both a local and systemic necrosis.

However, on other host plants the symptoms differ. On broad bean and pea Zaumeyer's virus induces a local and systemic necrosis whereas this virus causes a mosaic on broad bean, and malformation and stunt on pea. On cowpea, there is a local necrosis as well as a yellow mottle and malformation with the alfalfa yellow mosaic, but only local lesions develop with this virus.

Further, Zaumeyer's virus has a larger host range which includes solanaceous spp., and the physical properties differ.

Although this virus was isolated from *Lathyrus odoratus* the disease it causes on that host is very similar to many others, but on *Phaseolus vulgaris* the symptoms are unusual.

Therefore the name chosen for this virus is bean local chlorosis virus. Of the three strains described in England (9) there is most similarity with the B strain—the A strain induces a local chlorosis on broad bean and a local and systemic necrosis on pea, whereas the C strain causes a veinbanding on broad bean and a mottle only on pea. Physical property values also differ.

This virus is therefore considered the same as bean local chlorosis virus—strain B.

### 7. Bean Yellow Mosaic Virus, Necrotic Strain.

Physical properties: Thermal inactivation point, 58–60°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1: 1,000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. mutabilis* Sweet., *L. luteus* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *Vicia faba* L., *Voandzeia subterranea* Thouars.

#### REACTION OF SUSCEPTIBLE SPECIES.

##### *Crotalaria juncea*.

Local. No reaction.

Systemic. After 2 weeks the young leaves are chlorotic with dark green specks. Necrosis may set in, in the chlorosis and the plant may collapse. Usually the necrosis causes an uneven surface on the leaves which are small and malformed. The plant is stunted.

##### *C. spectabilis*.

Local. In 7 days there are chlorotic spots with a slight necrosis.

Systemic. At the same time the young leaves develop chlorotic spots or vein flecks. Later leaves are mottled and malformed with dark green blisters and necrotic specks. The plant is stunted.

##### *Glycine max*.

Local. No reaction.

Systemic. A diffuse chlorotic spotting develops.

##### *Lathyrus odoratus*.

Local. Some leaves become chlorotic (Fig. 7e).

Systemic. In 2 weeks the young leaves develop a vein clearing and chlorotic spotting. Later leaves are mottled and rolled (Fig. 7d).

*Lupinus albus.*

Local. No reaction.

Systemic. In 2 weeks the young leaves show a veinal necrosis. This may extend to the stem and the plant may collapse. Secondary shoots have small malformed and rolled leaves which are mottled. The plant is stunted.

*L. mutabilis.*

Local. No reaction.

Systemic. The young leaves curl back severely; there is a stem necrosis and the plant collapses.

*L. luteus.*

Local. No reaction.

Systemic. The young leaves remain folded and in 10 days there is a vein clearing and chlorotic spotting. The next ones are small and crinkled with dark green veinbands. Later leaves are almost stringlike. The plant is rosetted and stunted.

*Melilotus officinalis.*

A symptomless carrier.

*Phaseolus acutifolius.*

Local. No reaction.

Systemic. A diffuse chlorotic mottle develops on some leaves.

*P. lunatus.*

Local. No reaction.

Systemic. Only chlorotic vein flecks develop.

*P. vulgaris* var. Canadian Wonder.

Local. The leaves bend at right angles to the petiole and in 5-6 days there are chlorotic blotches and slightly necrotic veins (Fig. 7a). These leaves become leathery and remain attached.

Systemic. The first and second trifoliates also show a marked reflexing and they have chlorotic flecks or blotches. Later leaves develop a vein clearing, spotting or flecking and then a mottle. The next leaves are small and malformed and the plant is rosetted and stunted. The pods have sunken dark green areas (Fig. 7b).

var. Haricot.

Local. In 7 days there are chlorotic spots on the reflexed leaves.

Systemic. A week later, the first trifoliates bend down and show a vein clearing. Later leaves are mottled with dark green blisters. The plant is stunted, and the stem may have short necrotic streaks. The pods develop sunken necrotic rings.

vars. Black Wonder, Idaho Refugee, Long Tom and Tendergreen develop symptoms similar to those on Canadian Wonder.

var. S.A. Black and White shows no local reaction but the systemic is similar to Canadian Wonder.



*Pisum sativum.*

Local. In 6 days there may be necrotic rings or the leaves just wilt and collapse.

Systemic. Soon afterwards the young leaves develop a vein clearing and chlorotic spotting. Necrosis sets in on the leaves, stipules and stem, and the growing point collapses (Fig. 7f). Secondary shoots are stunted and rosetted, and the leaves are small, malformed and mottled. The tendrils are abnormally curled.

*Trifolium hybridum.*

Local. No reaction.

Systemic. After 3 weeks the young leaves show a vein clearing and chlorotic spotting. Later ones develop vivid yellow streaks and a slight puckering (Fig. 7c).

*T. incarnatum.*

Local. No reaction.

Systemic. After 2 weeks there is a vein clearing of the young leaves followed by a chlorotic veinbanding. The leaves are slightly puckered and the plant is stunted.

*Vicia faba.*

Local. No reaction.

Systemic. In 7 days the young leaves show a vein clearing, or chlorotic spots or flecks. Later leaves develop a mosaic.

*Voandzeia subterranea.*

Local. No reaction.

Systemic. Diffuse chlorotic spots develop on some leaves.

Natural source of virus: *Lathyrus odoratus* (Pretoria district). The leaves had chlorotic spots, veinbands or a mottle, and there was a colour break of the flowers.

## IDENTIFICATION.

There are several viruses which cause a reflexing of the bean leaves, but only with alsike clover mosaic virus 2 Zaumeyer (17) is this characteristic associated with a systemic necrosis on the pea. However, as the necrosis caused by the alsike virus results in the complete defoliation of the pea plant, and the physical properties differ, the casual virus is not the same as the one described here.

Although the type bean yellow mosaic virus Pierce (11) does not induce a necrosis on the pea, symptoms on many other hosts and the physical properties are very similar to this virus.

The bean yellow mosaic virus necrotic lesion strain of Zaumeyer and Fisher (19) is not infectious to pea, white lupin or crimson clover, all of which are hosts to this virus. Further, it induces a local and systemic necrosis on broad bean (whereas this virus causes a mosaic) and local lesions on tobacco, which is not susceptible to this virus.

The severe yellow strain of Thomas and Zaumeyer (13) is excluded as there are differences in the symptoms on several host plants and in the physical property values. It is also able to infect tobacco.

The bean yellow mosaic virus "Isolate I" of Hagedorn and Walker (7) does not cause any necrosis on the pea and other symptoms and properties also differ.

Although the virus described here does not infect the cowpea and remains latent in sweet clover, so many details are similar to a virus found in England by the writer (9), that it is considered to be the same, and is named bean yellow mosaic virus, necrotic strain.

### 8. Tomato spotted Wilt Virus. Samuel *et al.*

Physical properties: Thermal inactivation point, 40–42°C. Longevity *in vitro*, –1 day. Dilution end point, 1: 5,000–1: 10,000.

Transmission: Mechanical sap inoculation. *Thrips* spp.

Host range in *Leguminosae*: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *Medicago denticulata* L., *M. sativa* L., *Melilotus officinalis* Willd., *Phaseolus mungo* L., *Pisum sativum* L., *Trifolium fragiferum* L., *T. incarnatum* L., *T. pratense* L., *Vicia faba* L., *Vigna unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

#### REACTION OF SUSCEPTIBLE SPECIES.

##### *Arachis hypogaea.*

Local. Usually no reaction.

Systemic. There is a veinal necrosis of the young leaves and the growing point collapses. Secondary shoots are rosetted, with small, malformed leaves. These have concentric chlorotic patterns or dark green veinbands. Necrotic speckling may be severe.

##### *Crotalaria juncea.*

Local. There are necrotic spots in 5 days which enlarge by concentric bands (Fig. 8h).

Systemic. There are concentric chlorotic patterns and possibly a lethal necrosis.

##### *C. spectabilis.*

Local. Necrotic ringspots develop in 5 days. Later there is also a veinal necrosis (Fig. 8b).

Systemic. Some leaves are severely curled and have a chlorotic network.

##### *Glycine max.*

Local. There are necrotic specks with chlorotic haloes. The leaves later become almost orange (Fig. 8e).

Systemic. No reaction.

##### *Lathyrus odoratus.*

Local. Large necrotic lesions develop and the leaves soon absciss.

Systemic. The necrosis spreads into the main stem causing external streaks, and the plant eventually collapses.

##### *Lupinus albus.*

Local. Necrotic specks develop and the rest of the leaflet becomes chlorotic. The necrosis spreads and the leaflets drop (Fig. 8 j).

Systemic. No reaction.

##### *L. luteus.*

Local. There are chlorotic rings which soon become necrotic and the leaflets absciss.

Systemic. No reaction.

*Medicago denticulata.*

Local. A scorch necrosis causes a defoliation.

Systemic. There is a vein clearing of the young leaves followed by a veinal necrosis. Later leaves have necrotic ringspots (Fig. 8f).

*M. sativa.*

Local. There are necrotic ringspots on a vivid yellow background (Fig. 8i).

Systemic. No reaction.

*Melilotus officinalis.*

Local. Chlorotic ringspots develop in 10–11 days.

Systemic. No reaction.

*Phaseolus mungo.*

Local. Isolated necrotic lesions develop.

Systemic. No reaction.

*Pisum sativum.*

Local. After a general necrosis the leaves wilt.

Systemic. A veinal necrosis of the leaves follows, and young plants may collapse. On older plants there are necrotic spots on the leaves and necrotic streaks on the stems. (Fig. 8c). The pods may have necrotic lesions and the tendrils are abnormally curled.

*Trifolium fragiferum.*

Local. There are necrotic specks with chlorotic haloes in 5 days (Fig. 8g).

Systemic. No reaction.

*T. incarnatum.*

Local. Chlorotic spots with necrotic rings develop and there is a slight veinal necrosis.

Systemic. No reaction.

*T. pratense.*

Local. There are necrotic specks which enlarge and fuse to give a "scorch" effect.

Systemic. No reaction.

*Vicia faba.*

Local. A severe veinal necrosis may develop.

Systemic. Usually this necrotic effect is first seen on the young leaves. It is soon followed by sunken necrotic stem streaks and a collapse of the plant (Fig. 8a).

*Vigna unguiculata.*

Local. There are red necrotic spots with chlorotic rings.

Systemic. No reaction.

*Voandzeia subterranea.*

Local. Necrotic spots develop which later enlarge by concentric bands.

Systemic. A diffuse chlorotic mottle may occur.

Natural source of virus: The natural incidence of spotted wilt is high on peas, sweet peas and broad beans. On groundnuts and the *Crotalaria* spp. it occurs less frequently.

## IDENTIFICATION.

Sub-inoculations to several Solanaceous hosts proved that this is the tomato spotted wilt virus (12).

## HOST RANGES.

Host Plant.	1. Pea Mosaic Virus.	2. Pea Virus 2.	3. Pea Stunt Virus.	4. Pea Wilt Virus Strain.	5. Lucerne Mosaic Virus Strain.	6. Bean Local Chlorosis Virus B.	7. Bean Yellow Mosaic Virus Strain.	8. Tomato Spotted Wilt Virus.
<i>Arachis hypogaea</i> .....	+	—	—	+	—	—	—	+
<i>Crotalaria juncea</i> .....	+	—	+	+	+	—	+	+
<i>C. spectabilis</i> .....	—	—	+	+	+	+	+	+
<i>Dolichos lablab</i> .....	—	—	—	+	—	—	—	—
<i>Glycine javanica</i> .....	+	—	—	+	—	—	—	—
<i>G. max</i> .....	—	—	+	—	+	+	+	+
<i>Lathyrus odoratus</i> .....	+	+	+	+	+	+	+	+
<i>Lupinus albus</i> .....	+	+	+	+	+	+	+	+
<i>L. luteus</i> .....	+	+	+	+	+	+	+	+
<i>Medicago lupulina</i> .....	+	+	—	+	—	—	—	—
<i>M. sativa</i> .....	—	—	+	—	—	—	—	+
<i>Melilotus officinalis</i> .....	+	—	—	+	+	—	+	+
<i>Phaseolus acutifolius</i> ....	—	—	—	+	+	—	+	—
<i>P. lunatus</i> .....	—	—	—	+	—	—	+	—
<i>P. nungo</i> .....	+	—	—	+	—	—	—	+
<i>P. vulgaris</i> .....	+	+	+	+	+	+	+	—
<i>Pisum sativum</i> .....	+	+	+	—	+	+	+	+
<i>Trifolium fragiferum</i> ....	—	—	—	—	—	—	—	—
<i>T. hybridum</i> .....	+	+	+	+	+	+	+	—
<i>T. incarnatum</i> .....	+	—	+	+	—	—	—	+
<i>T. pratense</i> .....	+	+	—	+	—	—	—	+
<i>T. repens</i> .....	+	—	—	—	—	—	—	—
<i>Vicia faba</i> .....	+	+	+	+	+	+	+	+
<i>Vigna sesquipedalis</i> .....	—	—	+	+	—	—	—	—
<i>V. unguiculata</i> .....	—	—	+	+	+	+	—	+
<i>Voandzeia subterranea</i> ..	—	—	+	+	+	—	+	+

## PHYSICAL PROPERTIES AND METHODS OF TRANSMISSION.

Virus.	Thermal Inactivation Point °C.	Longevity in vitro Days.	Dilution End Point.	Transmission.		
				Sap.	Seed.	Aphid.
1. Pea mosaic virus.....	56-58	2-3	1: 1,000-1: 2,000	+	—	+
2. Pea virus 2.....	60-62	3-4	1: 1,000-1: 2,000	+	—	+
3. Pea stunt virus.....	60-62	2-3	1: 5,000-1: 10,000	+	—	—
4. Pea wilt virus strain.....	58-60	2-3	1: 10,000	+	—	+
5. Lucerne mosaic virus necrotic ring strain.....	62-65	7-8	1: 3,000-1: 5,000	+	—	+
6. Bean local chlorosis virus B.	58-60	2-3	1: 1,000-1: 2,000	+	—	+
7. Bean yellow mosaic virus necrotic strain.....	58-60	2-3	1: 1,000	+	—	+
8. Tomato spotted wilt virus...	40-42	-1	1: 5,000-1: 10,000	+	—	—



## SYMPTOMS ON THE MAIN TEST PLANTS.

Virus.	<i>Phaseolus vulgaris.</i>	<i>Vicia faba.</i>	<i>Pisum sativum.</i>
1. Pea mosaic virus.....	Loc. no reaction Syst. chl. blo. (?)	Loc. no Syst. mosaic	Loc. no Syst. mosaic, ros.
2. Pea virus 2.....	Loc. no Syst. csp., stunt	Loc. no Syst. csp. mosaic	Loc. necrosis. Syst. mosaic, ros.
3. Pea stunt virus.....	Loc. no Syst. mot., stunt	Loc. no Syst. mos., 1 & n.	Loc. no Syst. mos., necr. s.s.
4. Pea wilt virus strain.....	Loc. no Syst. mot.	Loc. necr. rings Syst. no	Loc. coll. Syst. mot., necr. s.s.
5. Lucerne mosaic virus necrotic ring strain	Loc. csp., necr. O Syst. no	Local. necr. sp. Syst. c.sp., necr. coll.	Loc. necr. O Syst. c.fl., necr. coll.
6. Bean local chlorosis virus B	Loc. vivid c.sp. Syst. mos., malf.	Loc. no Syst. c.sp., mos.	Loc. no Syst. c.sp., malf., necr. s.s.
7. Bean yellow mosaic virus necrotic strain	Loc. reflexing Syst. 7, mot., malf.	Loc. no Syst. c.sp., mos.	Loc. necrosis Syst. necr. coll.
8. Tomato spotted wilt virus	Loc. no Syst. no	Loc. necrosis Syst. necr. coll.	Loc. necrosis Syst. necr. coll.

## ABBREVIATIONS USED:

blo.—blotches.  
c. } chlorotic.  
chl. }  
coll.—collapse.  
fl.—flecks.  
loc.—local.

1 & n—long and narrow leaves.  
malf.—malformation.  
mos.—mosaic.  
mot.—mottle.  
necr.—necrotic/necrosis.  
no—no reaction.  
ros.—rosette.  
sp.—spots.  
s.s.—stem streaks.  
syst.—systemic.  
O—rings.  
7—reflexing.

## SUMMARY.

The virus diseases which occur naturally on peas and sweet peas in South Africa are described in detail.

In the field, peas develop mosaic and/or necrotic symptoms. The mosaic is caused by the pea mosaic virus or pea virus 2; the necrosis (and ultimate collapse) by the lucerne mosaic virus necrotic ring strain or by the tomato spotted wilt virus; and a mosaic with necrotic stem streaks by pea stunt virus or a strain of the pea wilt virus.

Symptoms on naturally infected sweet peas are similar viz. a mosaic develops with the pea mosaic virus, the necrotic strain of bean yellow mosaic or the bean local chlorosis virus B. A necrosis develops with the lucerne mosaic virus necrotic ring strain or with the tomato spotted wilt virus; and mosaic plus necrotic stem streaks develops with the pea stunt virus.

Of these, tomato spotted wilt has already been reported as a virosis of legumes in South Africa, but the others are new records.

Pea mosaic virus, pea virus 2 and pea stunt virus were identified by comparing with published descriptions.

Three others were found to be very similar to, but not identical with previously described viruses, and are considered to be strains of the type viruses, viz. a strain of the pea wilt virus, bean yellow mosaic virus necrotic strain, and lucerne mosaic virus necrotic ring strain.

One is apparently a new entity, and is named bean local chlorosis virus B, after the characteristic reaction on the bean.

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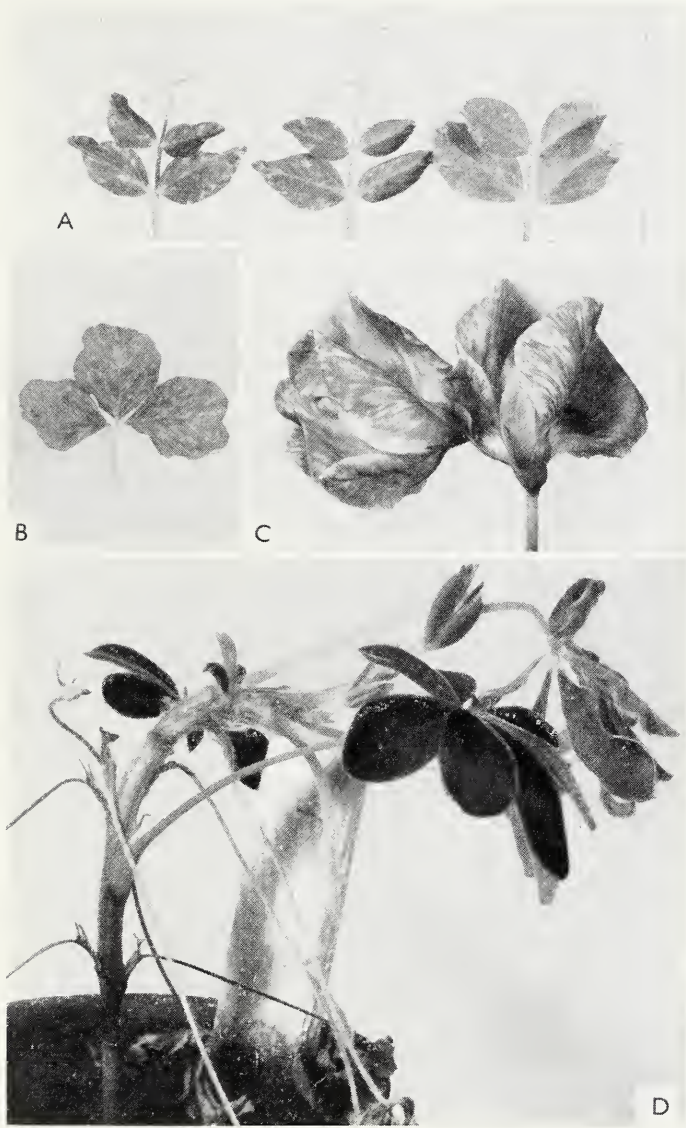


FIG. 1.—PEA MOSAIC VIRUS.

A. *Pisum sativum*. B. *Trifolium incarnatum*. C. *Lathyrus odoratus*. D. *Lupinus albus*.



FIG. 2.—PEA VIRUS 2.

A. *Pisum sativum*. B. *Phaseolus vulgaris*. C. *Vicia faba*. D. *Lupinus albus*.



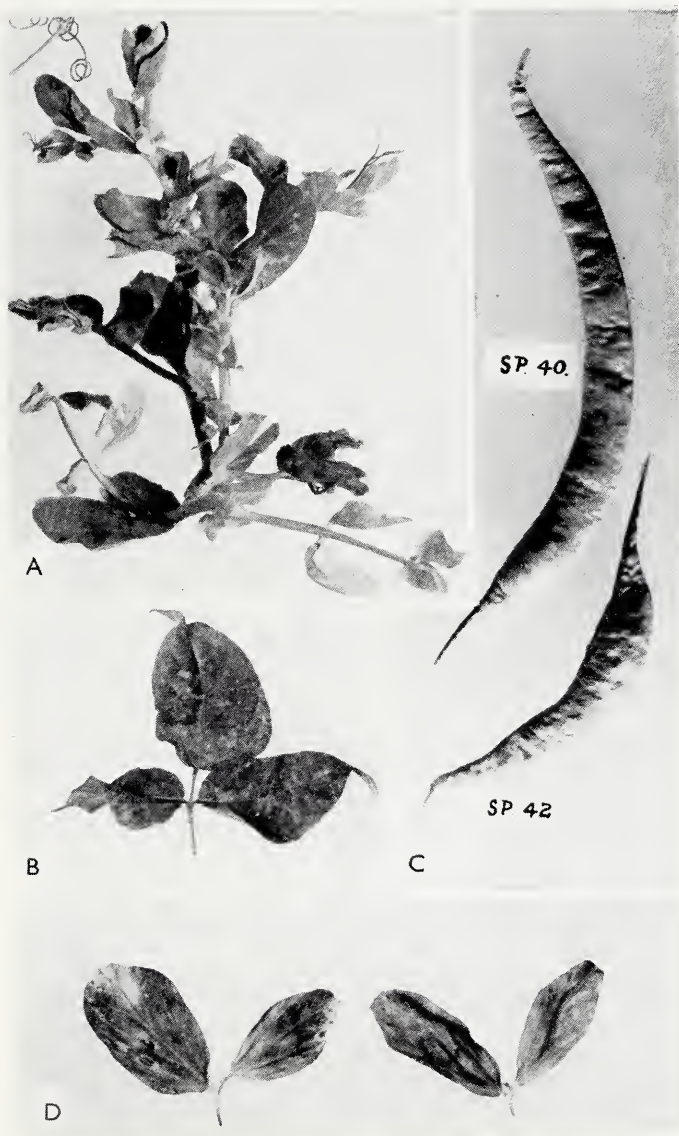


FIG. 3.—PEA STUNT VIRUS.

A. *Pisum sativum*. B. and C. *Phaseolus vulgaris*. D. *Vicia faba*.



FIG. 4.—PEA WILT VIRUS. STRAIN.

A. *Pisum sativum*. B. *Vicia faba* (local lesions). C. *Trifolium pratense* D. *Phaseolus vulgaris*.

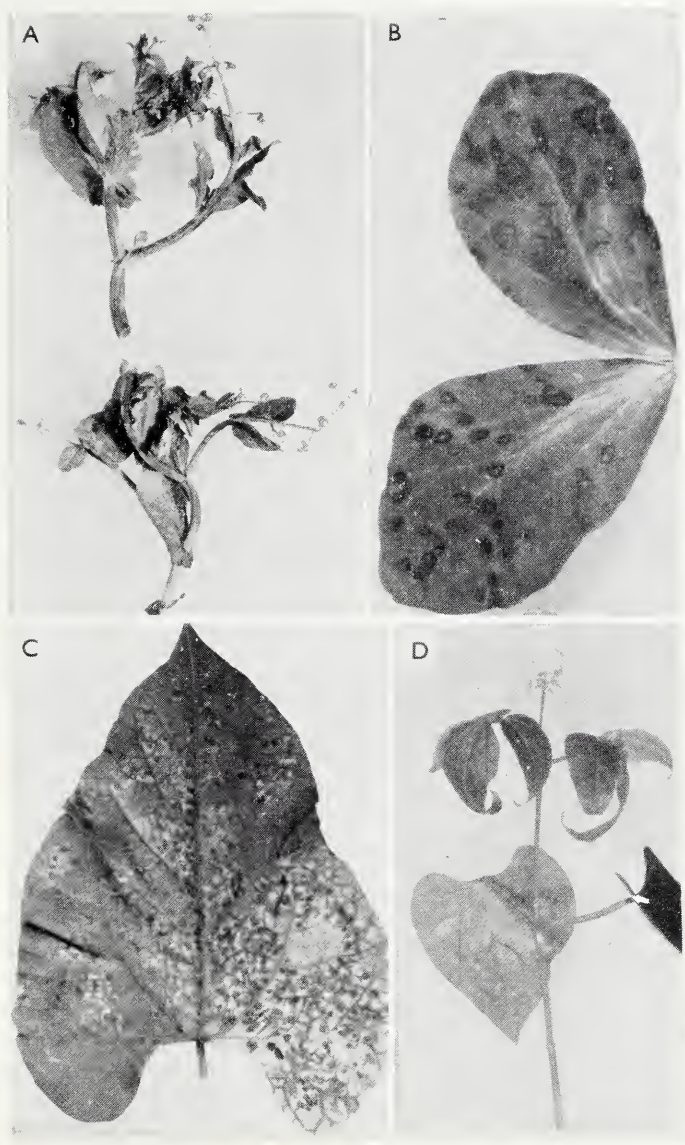


FIG. 5—LUCERNE MOSAIC VIRUS, NECROTIC RING STRAIN.

A. *Pisum sativum*. B. *Vicia faba* (local lesions). C. *Phaseolus vulgaris* var. Canadian Wonder (local lesions). D. *Phaseolus vulgaris* var. Haricot.

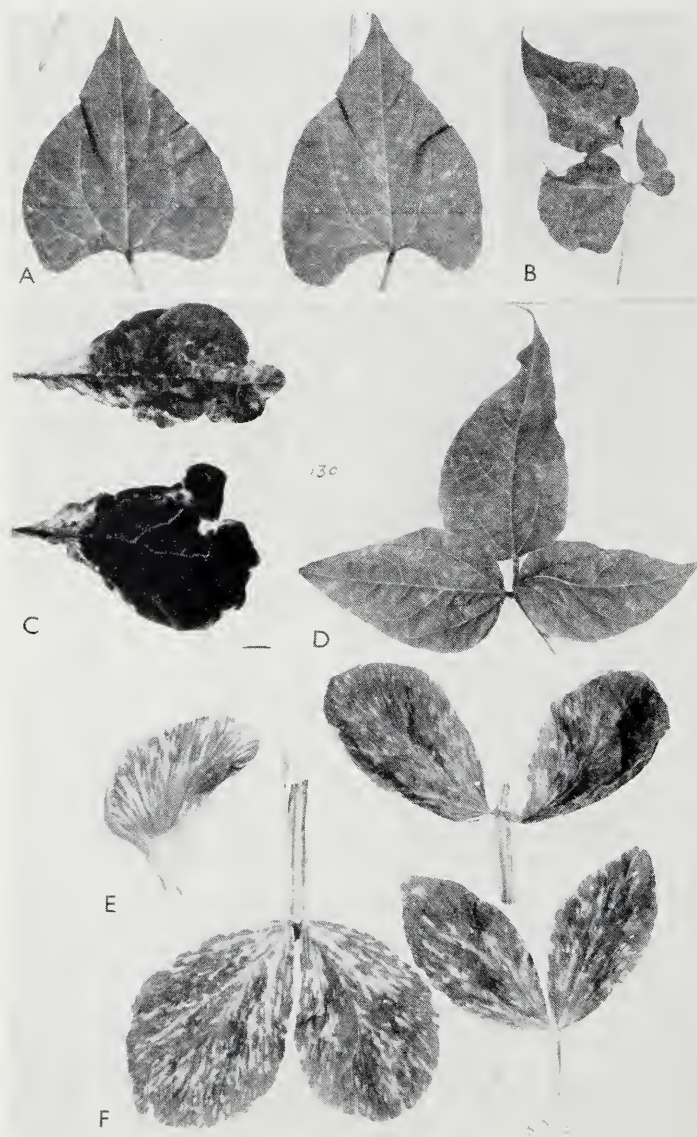


FIG. 6.—BEAN LOCAL CHLOROSIS VIRUS B.

A., B. and D. *Phaseolus vulgaris* A. local lesions. B. and D. systemic reaction.  
C. *Crotalaria spectabilis*. E. and F. *Lathyrus odoratus*.



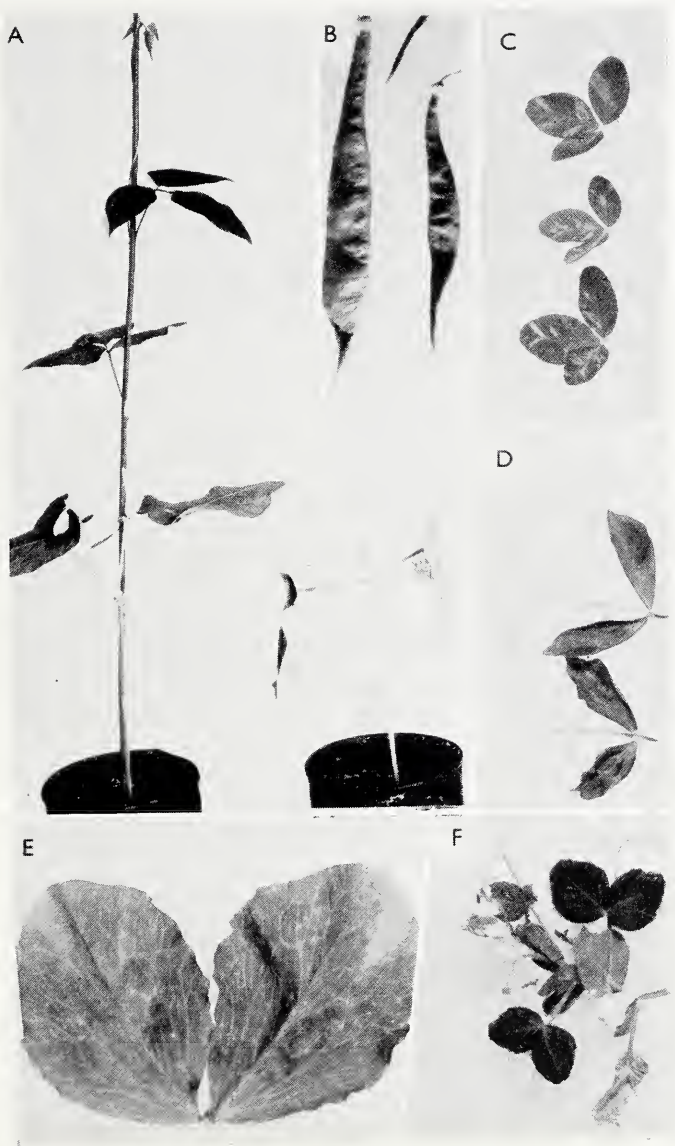


FIG. 7.—BEAN YELLOW MOSAIC VIRUS, NECROTIC STRAIN.

A. and B. *Phaseolus vulgaris*. C. *Trifolium hybridum*. D. and E. *Lathyrus odoratus*. F. *Pisum sativum*.



FIG. 8.—TOMATO SPOTTED WILT VIRUS.

A. *Vicia faba*. B. *Crotalaria spectabilis*. C. *Pisum sativum*. D. *Nicotiana glutinosa*. E. *Glycine max*. F. *Medicago denticulata*. G. *Trifolium fragiferum*. H. *Crotalaria juncea*. I. *Medicago sativa*. J. *Lupinus albus*.

# Virus Diseases of Broad Beans.

By

Patricia J. Klesser.

Broad beans are not grown extensively in South Africa. The viruses described here were found on naturally infected *Vicia faba* plants grown in isolated areas of the Transvaal, and they are possibly not characteristic for the whole country.

In the field, the symptoms are: mosaic, mosaic with stunt, or severe necrosis and collapse.

The viruses causing mosaic symptoms are found frequently. An unusual feature of this mosaic is the fact that the chlorotic areas are depressed below the normal surface of the leaf.

The systemic necrosis is caused by the tomato spotted wilt virus, which is described in detail in the paper on pea virus diseases. The incidence of this disease can be fairly high, with severe crop losses; but usually it occurs only sporadically throughout a planting.

## REVIEW OF LITERATURE.

Although Elliot transmitted a mosaic from clover to broad bean in 1921, the first descriptions of naturally occurring mosaic diseases of broad bean were those of Böning 1927, van der Meulen 1928, Merkel 1929 and Fukushi 1930.

Imai 1934 successfully transmitted a virus causing mosaic on broad bean, to broad bean, pea and sweet pea, by both aphids and sap.

Further reports of broad bean mosaics came from Gigante in Italy (9); Yu in China (25); d'Oliviera in Portugal (5); and Quantz in Germany (17).

Murayama (14) determined the physico-chemical properties of a mosaic of broad beans in Japan.

Pierce (16) described the broad bean local lesion virus which he isolated from red clover, and which Weiss (22) considers to be the same as the pea wilt virus of Johnson (12).

Weiss regards the mosaic virus of Böning as being identical with the common pea mosaic virus. Further, he groups the viruses of Merkel, Murayama and Yu together, and suggests a relationship with either the bean yellow mosaic or the pea mottle viruses.

Other types of viroses found naturally on broad bean are the mild mosaic and rosette of Yu (25, 26); a vascular wilt—Stubbs (20); a mottle—Bawden, Chaudhuri & Kassanis (1); a soil-borne necrotic mosaic—Fujikawa (7) and tomato spotted wilt, Yu (27).

Rubio & van Slogteren studied the X-bodies associated with the mottle virus (18).

When artificially inoculated, broad beans develop systemic mosaic or necrotic symptoms with most of the legume viruses (10, 15, 16, 28, 29, 30, 31, 32) and also with the tobacco ringspot virus (24) and the curly top virus (19).

With celery virus 1, only local lesions develop (23).

## METHODS AND MATERIALS.

Naturally infected broad bean plants were collected from several parts of the Transvaal. The viruses were inoculated to a number of species of *Leguminosae*, and also to several *Solanaceous* plants. (None of the latter was susceptible).

Carborundum power was used for the sap inoculations and *Aphis fabae* and *A. craccivora* for the insect transmission tests.

### 1. Broad Bean Mosaic Virus A.

Physical properties: Thermal inactivation point, 55–56°C. Longevity *in vitro*, 2–3 days. Dilution end point, 1: 1,000.

Transmission: Mechanical sap inoculation. *Aphis fabae*.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

### REACTION OF SUSCEPTIBLE SPECIES.

#### *Arachis hypogaea*.

Local. No reaction.

Systemic. There is a diffuse chlorotic mottle.

#### *Crotalaria juncea*.

Local. There are necrotic spots after 8 days. These fuse and the leaves drop.

Systemic. In 12 days necrosis has spread up the stem and into the veins of the young leaves (Fig. 1b). The plant may collapse or may have malformed rolled leaves, with dark green blisters.

#### *C. spectabilis*.

Local. No reaction.

Systemic. After 3 weeks the young leaves develop irregular chlorotic areas, which cause a malformation of the leaves, due to uneven growth of the laminae. Soon necrosis sets in in these areas. Later formed leaves have chlorotic line patterns which become necrotic to produce an "etched" effect. Older leaves may show necrotic rings without any chlorosis.



*Glycine max.*

Local. No reaction.

Systemic. A few leaves show a chlorotic mottle, the young leaves being symptomless. Some old leaves have vivid yellow spots with central necrotic specks.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. Most leaves are rolled and have dark green streaks.

*Lupinus albus.*

Local. Chlorotic spots with dark green rings can be seen after 11 days. The leaflets drop.

Systemic. The young leaves show a vein clearing, and they remain folded and have wavy margins. Later leaves develop small chlorotic spots and then dark green blisters. The latter leaves are crinkled and may be malformed. The growing point is rosetted and stunted.

*L. luteus.*

Local. No reaction.

Systemic. In 8 to 9 days small chlorotic spots develop on the young leaves. After 3 weeks most leaves are small, malformed and mottled. The plant is stunted. There may be enough necrosis to cause the collapse of the plant.

*L. mutabilis.*

Local. No reaction.

Systemic. The young leaves have chlorotic specks. Later ones are chlorotic with dark green blisters and malformation. The plant is rosetted.

*Medicago lupulina.*

Local. No reaction.

Systemic. The young leaves develop chlorotic streaks and later leaves are mottled and slightly puckered.

*Melilotus officinalis.*

Local. No reaction.

Systemic. The plant is stunted and the leaves have chlorotic vein streaks.

*Phaseolus acutifolius.*

Local. In 4 days there are chlorotic spots and the veins become necrotic.

Systemic. After 12 days the young leaves develop a vein clearing with small chlorotic spots. There is necrosis in the chlorosis (Fig. 1e) and the growing point may collapse. Later formed leaves are mottled.

*P. lunatus.*

Local. In 7 to 8 days necrotic lesions develop and there are large chlorotic areas.

Systemic. The necrosis spreads quickly into the stem and veins of the young leaves, and the plant collapses.

*P. mungo.*

Local. No reaction.

Systemic. A diffuse spot mottling develops.

*P. vulgaris* var. Canadian Wonder.

Local. There are irregular chlorotic areas which fuse to a general chlorosis.

Systemic. In 6 days the young leaves show a vein clearing. Later leaves develop a diffuse chlorotic spotting and the older leaves have large chlorotic blotches.

var. Haricot.

Local. Within a week there are chlorotic blotches.

Systemic. At the same time the young leaves curl down severely. They are crinkled and chlorotic.

*Pisum sativum.*

Local. In 8 days the leaves show small necrotic specks.

Systemic. Soon after, the young leaves develop a vein clearing with small necrotic specks. Later leaves and stipules are all similarly speckled and the stem develops purple necrotic streaks which may result in the collapse of the plant. If not, the leaves are rosetted and folded with irregular dark green areas and the tendrils are abnormally curled.

*Trifolium hybridum.*

Local. No reaction.

Systemic. Most leaves show a chlorotic streak mottle and slight crinkle after about 3 weeks.

*T. incarnatum.*

Local. No reaction.

Systemic. After 9 days the young leaves show a vein clearing. Later leaves have irregular chlorotic areas and are crinkled. Some may have necrotic spots or veins (Fig. 1c).

*T. pratense.*

Local. No reaction.

Systemic. A chlorotic streak mottle develops (Fig. 1d).

*Vicia faba.*

Local. No reaction.

Systemic. In 9 days the young leaves show a vein clearing. Later formed leaves develop chlorotic spots or dark green streaks and then a mosaic. A characteristic of this mosaic is that the chlorotic areas are sunken below the leaf surface, resulting in the dark green streaks being apparently raised. (Fig. 1a). The leaves are also rolled and the plant is slightly stunted.

*Vigna sesquipedalis.*

Local. Isolated chlorotic areas develop.

Systemic. Only the first and second trifoliates show a diffuse chlorotic mottle.

*V. unguiculata.*

Local. There are chlorotic spots in 4 days, and the leaves become flaccid and drop.

Systemic. After 9 to 10 days the young leaves develop a vein clearing. Later ones are diffusely mottled.

*Voandzeia subterranea.*

Local. No reaction.

Systemic. After 3 weeks the leaves show a chlorotic network and irregular chlorotic areas.

Natural source of virus: *Vicia faba*. The plants were slightly stunted and the leaves were rolled and elongated. They had a mosaic mottle with the chlorotic areas depressed below the dark green or normal coloured areas.

## IDENTIFICATION.

The characteristic symptom of this virus on broad bean, is a mosaic with the chlorotic areas depressed. This apparently occurs with only one other described virus.

Böning (3) mentions a similar effect with his virus, which was later identified as the common pea mosaic virus. However, the pea mosaic is not transmissible to bean (which is a host of this virus) and causes a mosaic on pea and not a necrosis which is usual with this virus.

Although pea virus 2 Osborn (15) is able to infect bean, the symptoms on pea are again chlorotic and not necrotic.

This necrotic reaction on pea can be compared with several others:

- (a) The alfalfa mosaic virus 1B Zaumeyer (29) causes a similar local and systemic necrosis on the pea, but only a local necrotic spotting on the bean, whereas this virus induces a mottle only. Moreover this alfalfa mosaic results in a necrotic collapse of the broad bean.
- (b) The pea American streak virus Zaumeyer (28) is non-infectious to the bean, causes a local reaction on broad bean and withstands a temperature of 10° higher than this virus.
- (c) The pea Wisconsin streak virus Hagedorn & Walker (10) is not able to infect either bean or broad bean.
- (d) The pea New Zealand streak virus Chamberlain (4) causes a local and systemic necrosis of the bean (whereas this virus induces a mottle only), and broad bean is not included in the host range. Further, there is a great difference in the physical property values of the 2 viruses.
- (e) The alsike clover mosaic virus Zaumeyer & Wade (32) results in a conspicuous reflexing of the bean leaves, which does not occur with this virus.
- (f) The white clover mosaic virus complex Zaumeyer & Wade (31) induces a necrosis on both the bean and broad bean, both of which show a mottle with this virus.
- (g) Although the symptoms of the pea stunt virus Zaumeyer (30) on pea and bean are similar to this virus, symptoms on other hosts, the host range and the physical property values are different.

Pierce's broad bean local lesion virus (16) causes only a local necrosis on broad bean, while Stubbs' virus (20) induces a severe systemic necrosis.

The mild mosaic virus of Yu (25) is unable to infect bean, cowpea and soybean (all of which are hosts of this virus) and does not withstand more than 3 hours ageing, whereas this virus lasts 2-3 days *in vitro*.

The broad bean mottle virus Bawden, Chaudhuri & Kassanis (1) induces symptoms similar to this virus on bean, pea, sweet pea and the clovers, but differs on soybean and broad bean. (During the initial subinoculations with the mottle virus, broad bean developed a systemic necrosis as well, but later, only a mottle). However, Bawden's virus withstood heating up to 95°C., and ageing up to 20 days. Further it was not transmissible by any of the *Aphis* species.

As this virus cannot be fully identified with any previously described, it may be a new virus or strain. It is named broad bean mosaic virus A.

## 2. Broad Bean Mosaic Virus B.

Physical properties: Thermal inactivation point, 56-58°C. Longevity *in vitro*, 1-2 days. Dilution end point, 1: 1,000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Crotalaria juncea* L., *C. spectabilis* Roth., *Lupinus albus* L. vars. sweet and bitter, *Phaseolus lunatus* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

### REACTION OF SUSCEPTIBLE SPECIES.

#### *Crotalaria juncea*.

Local. No reaction.

Systemic. In 8 days the young leaves develop a vein clearing and spotting. The next leaves have chlorotic streaks which lead to a malformation. Later leaves are small and rolled and have dark green blisters. (Fig. 2c). The plant is stunted.

#### *C. spectabilis*.

Local. No reaction.

Systemic. In 13 days there are chlorotic spots and vein flecks on the young leaves. Later leaves have broad alternate chlorotic and green veinbands (Fig. 2c). There may be necrotic stem streaks.

#### *Lupinus albus* var. Sweet.

Local. After 13 days the leaves have chlorotic spots with necrotic veins, and they soon drop.

Systemic. At the same time the young leaves remain folded and have small chlorotic spots. Later formed leaves are small, malformed and mottled. The growing point is rosetted and the plant stunted.

var. Bitter.

Local. No reaction.

Systemic. The first leaves are mottled. Later the growing point becomes rosetted with small chlorotic leaves. There may be necrotic stem streaks.



*Phaseolus lunatus.*

Local. No reaction.

Systemic. After 3 weeks chlorotic vein flecks develop (Fig. 2b).

*P. vulgaris* var. Canadian Wonder.

Local. In 11 to 12 days large chlorotic blotches appear.

Systemic. The first few trifoliates develop large chlorotic areas (Fig. 2d). New leaves are symptomless.

var. Haricot.

Local. In 10 to 12 days there are small chlorotic areas.

Systemic. Soon after, the young leaves curl down and have a chlorotic network. Later formed leaves are small, puckered and mottled.

*Pisum sativum.*

Local. No reaction.

Systemic. After 11 to 12 days the young leaves show a vein clearing and spotting. The next formed leaves develop a mosaic, and the tendrils are abnormally curled. Necrosis of the growing point leads to the eventual collapse of the plant.

*Trifolium hybridum.*

A symptomless carrier.

*T. incarnatum.*

Local. No reaction.

Systemic. The young leaves show a chlorotic network and flecking in 11 days. Later leaves are crinkled and have a mosaic mottle. (Fig. 2a). The plant is severely stunted.

*Vicia faba.*

Local. No reaction.

Systemic. In 18 days chlorotic spots develop on the young leaves. Later leaves show a mosaic with the chlorotic areas depressed, leaving raised dark green islands.

*Vigna sesquipedalis.*

Local. No reaction.

Systemic. There is a chlorotic network followed by a chlorotic spotting.

*V. unguiculata.*

Local. No reaction.

Systemic. The young leaves show small chlorotic specks after 18 days. Later ones are chlorotic with short dark green veinbands, and are rolled downwards.

*Voandzeia subterranea.*

A symptomless carrier.

Natural source of virus: *Vicia faba*. Although the mosaic symptoms on the leaves were similar to those on the plants from which the A virus was isolated, there was little stunt or rolling. The general appearance of the plants was normal.

*Crotalaria spectabilis*. Most leaves had bands of vivid yellow and dark green. There was also a slight veinal necrosis.

## IDENTIFICATION.

This virus is very similar to the previous one, but differences in host range, physical property values and symptoms on some plants are too marked for it to be classified as the same.

As this virus also results in the typical sunken chlorotic reaction on the broad bean, it is named broad bean mosaic virus B.

## SYMPTOM DIFFERENCES BETWEEN BROAD BEAN MOSAIC VIRUSES A AND B.

Host plant.	Virus A.	Virus B.
<i>Crotalaria juncea</i> .....	Loc. necr. spots. Syst. necr. coll.	Loc. no reaction. Syst. chl. str., d.gr. bl., malf.
<i>C. spectabilis</i> .....	Loc. no. Syst. irreg. chl., malf., necr. patterns.	Loc. no. Syst. chl. spots, d.gr. veinb., necr. s.s.
<i>Phaseolus lunatus</i> .....	Loc. necr. lesions. Syst. necr. coll.	Loc. no. Syst. chl. flecks.
<i>Pisum sativum</i> .....	Loc. necr. specks. Syst. necr. specks, coll.	Loc. no. Syst. mos., necr. coll.
<i>Trifolium hybridum</i> .....	Loc. no. Syst. chl. streak mot.	Symptomless carrier.
<i>Vigna sesquipedalis</i> ..... { <i>V. unguiculata</i> ..... }	Loc. chl. spots. Syst. chl. mot.	Loc. no. Syst. chl. spots or veinb.
<i>Voandzeia subterranea</i> .....	Loc. no. Syst. chl. veins and areas.	Symptomless carrier.

Abbreviations used:—

bl.—blisters.

chl.—chlorosis/chlorotic.

coll.—collapse.

d. gr.—dark green.

irreg.—irregular.

malf.—malformed.

mos.—mosaic.

mot.—mottle.

no.—no reaction.

necr.—necrosis/necrotic.

n.s.s.—necrotic stem streak.

str.—streaks.

veinb.—veinbands.

## PHYSICAL PROPERTIES AND METHODS OF TRANSMISSION.

Virus.	Thermal inactivation point °C.	Longevity <i>in vitro</i> Days.	Dilution end point.	Transmission.		
				Sap.	Seed.	Aphis.
A.....	55–56	2–3	1: 1,000	+	—	+
B.....	56–58	1–2	1: 1,000	+	—	+

## HOST RANGES.

Host plant.	Virus A.	Virus B.
<i>Arachis hypogaea</i> .....	+	
<i>Crotalaria juncea</i> .....	+	+
<i>C. spectabilis</i> .....	+	+
<i>Dolichos lablab</i> .....		-
<i>Glycine javanica</i> .....	-	
<i>G. max</i> .....	+	- (?)
<i>Lathyrus odoratus</i> .....	+	- (?)
<i>Lupinus albus</i> .....	+	+
<i>L. luteus</i> .....	+	-
<i>L. mutabilis</i> .....	+	-
<i>Medicago lupulina</i> .....	+	-
<i>M. sativa</i> .....	-	
<i>Melilotus officinalis</i> .....	+	
<i>Phaseolus acutifolius</i> .....	+	
<i>P. lunatus</i> .....	+	+
<i>P. mungo</i> .....	+	
<i>P. vulgaris</i> .....	+	+
<i>Pisum sativum</i> .....	+	+
<i>Trifolium fragiferum</i> .....	-	
<i>T. hybridum</i> .....	+	+
<i>T. incarnatum</i> .....	+	+
<i>T. pratense</i> .....	+	
<i>T. repens</i> .....	-	-
<i>Vicia faba</i> .....	+	+
<i>Vigna sesquipedalis</i> .....	+	+
<i>V. unguiculata</i> .....	+	+
<i>Voandzeia subterranea</i> .....	+	+

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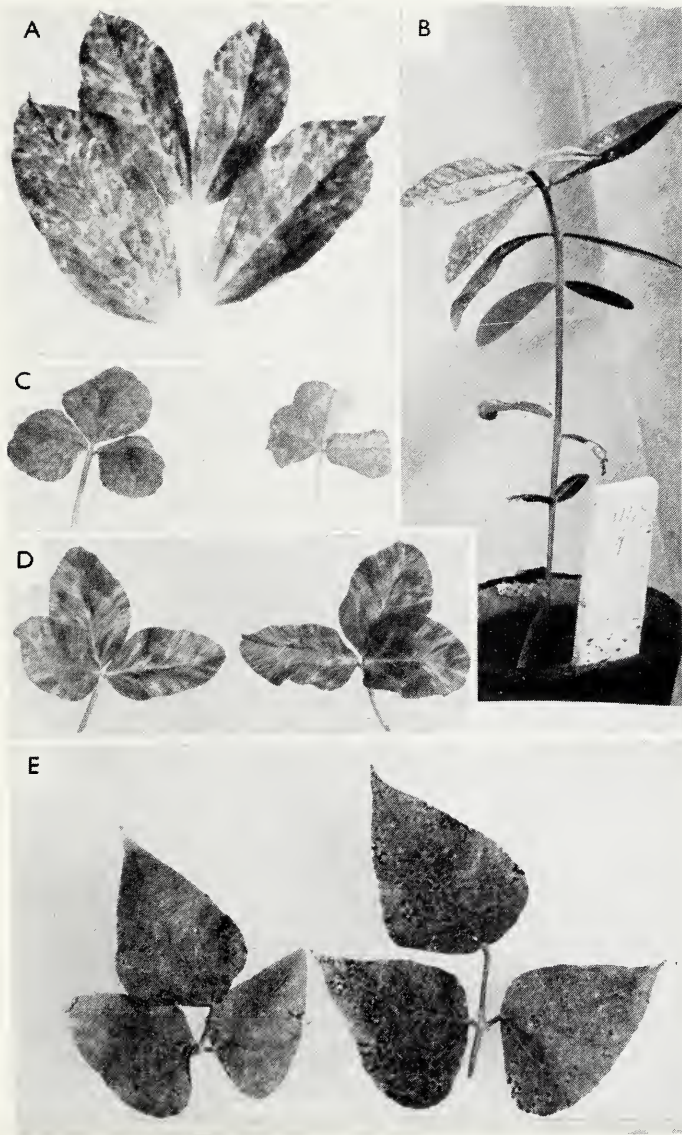


FIG. 1.—BROAD BEAN MOSAIC VIRUS A.

A. *Vicia faba*—showing depressed chlorotic areas. B. *Crotalaria juncea*.  
C. *Trifolium incarnatum*. D. *Trifolium pratense*. E. *Phaseolus lunatus*.

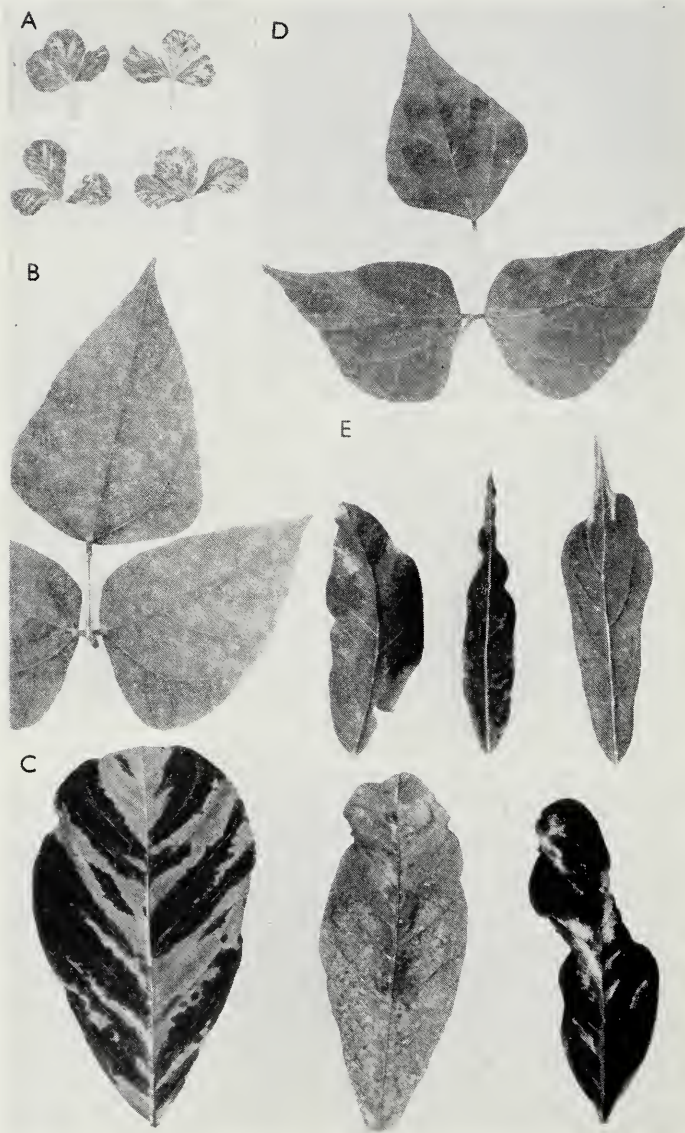


FIG. 2.—BROAD BEAN MOSAIC VIRUS B.

A. *Trifolium incarnatum*. B. *Phaseolus lunatus*. C. *Crotalaria spectabilis*.  
D. *Phaseolus vulgaris*. E. *Crotalaria juncea*.

# Chromosome Morphology in *Kniphofia*.

By

J. M. J. de Wet.

## ABSTRACT.

A number of species and varieties of the genus *Kniphofia* (Liliaceae) were studied cytologically. The somatic chromosome number is  $2n = 12$  in all the species. This is also true in *Notosceptrum natalense* Baker.

## MATERIAL AND METHODS.

The material studied was collected in the veld and cultivated on the Prinshof Experiment Station in Pretoria. The collectors' numbers listed in Table 1 also refer to the specimens filed with the National Herbarium, Pretoria. Root-tips were fixed in Randolph's (1935) fluid, dehydrated using normal butyl alcohol and embedded in a paraffin-beeswax-rubber mixture. Sections were stained in Stockwell's (1934) fluid. Inflorescences were fixed in 3: 1 absolute ethyl alcohol, propionic acid. Anthers were squashed in propionic-carmin after the method outlined by Swaminathan, Magoon and Mehra (1954). Karyotypes were computed with the aid of a camera lucida, using the average length of chromosomes from five different metaphase plates. The magnification is X2,500.

## CHROMOSOME NUMBER.

The genus was previously studied by Webber (1932), Moffet (1932) and Janaki-Ammal (1950), demonstrating  $n = 6$ . Polyploidy appears to be absent except in a triploid specimen of *K. snowdenii* from Uganda (Janaki-Ammal, 1950). The species studied are listed in Table 1. Polyploid cells were observed in otherwise normal diploid roots of *K. sp.* (Codd 1955). This is also true among pollen mother cells of this species. In these cells quadrivalents, together with a varying number of bivalent and univalents, were observed. Similar observations were made by Moffet (1932) in polyploid cells of *K. triangularis* (= *K. nelsonii*). In the diploid pollen mother cells, chromosome pairing and movement are normal.

## CHROMOSOME MORPHOLOGY.

The haploid chromosome set of  $n = 6$  in *Kniphofia* may be subdivided into three distinct groups. Two chromosomes are significantly longer than the rest. Both are characterized by secondary constrictions. They differ from each other in the position of the centromere.

Three chromosomes are of medium length. One of these is characterized by a secondary constriction, whereas the other two differ from each other in the position of the centromere. The sixth chromosome is short with a submedian centromere.

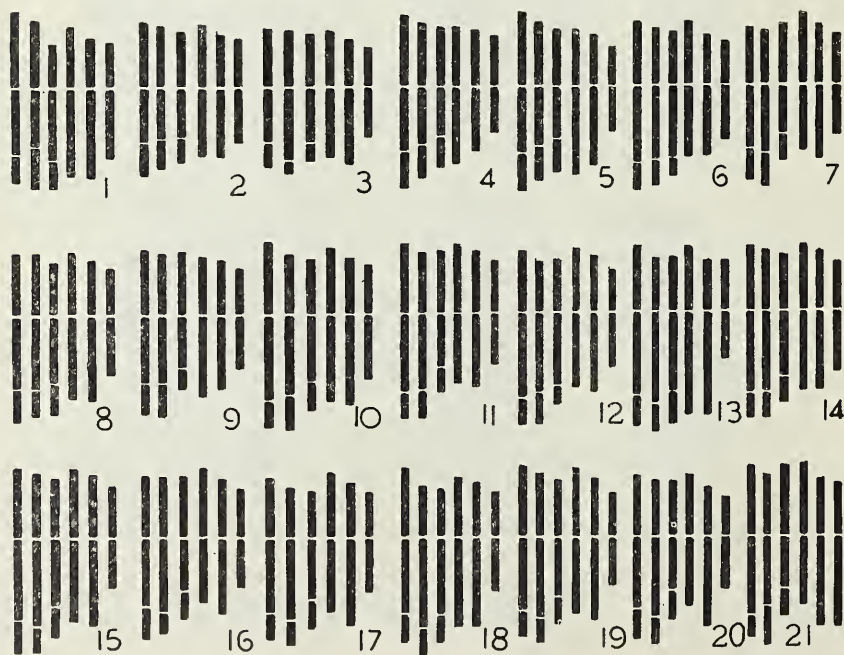
The material of *Notosceptrum* resembles *Kniphofia* in karyotype except for the sixth chromosome which is also of medium length. The karyotype varies very little from one species of *Kniphofia* to the other.

During meiotic telophase six nucleoli are always produced. This indicates the presence of six chromosomes with nucleoli organizing regions (Pathak, 1940, Gates, 1942, de Wet, 1953). These are evidently the six chromosomes (three chromosome pairs) with secondary constrictions.



TABLE 1.—*Chromosome numbers in Kniphofia and Notosceptrum.*

Name.	Origin.	Collector.	2n	Fig.
<i>Kniphofia</i> —				
<i>K. baurii</i> Bak.....	Newcastle.....	Codd 6509.....	12	1
<i>K. bachmanii</i> Bak.....	S.W. Cape.....	van Breda s.n.....	12	2
<i>K. caulescens</i> Bak.....	Nottingham Rd.....	Smuts s.n.....	12	3
<i>K. ensifolia</i> Bak.....	Linokana.....	Bruce 231.....	12	4
(= <i>K. rivularis</i> Berger).....	Pretoria.....	Codd 4777.....	12	
<i>K. ensifolia</i> Bak. var. <i>albiflora</i> E. A. Bruce.....	Kransberg.....	Bruce 56.....	12	5
<i>K. ichopensis</i> Schinz.....	Tabamhlope.....	Killick s.n.....	12	6
<i>K. macowanii</i> Bak.....	Wuthering Heights..	Codd 8530.....	12	7
<i>K. multiflora</i> Bak.....	Wonderhoogte.....	Codd s.n.....	12	8
<i>K. obtusiloba</i> Diels ex Berger.....	Slaaihoek.....	Codd 8274.....	12	9
<i>K. porphyrantha</i> Bak.....	Belfast.....	Codd 7592.....	12	10
(= <i>K. conrathii</i> Bak.).....	Pretoria.....	Codd 4776.....	12	
<i>K. sp.</i> .....	Cathedral Peak.....	Killick 1466.....	12	11
<i>K. praecox</i> Bak.....	E. Cape.....	Bruce 522.....	12	12
<i>K. rhodesiana</i> Rendle.....	Mariepskop.....	Codd 7922.....	12	13
<i>K. rooperi</i> (Moore) Lem.....	Sunwich Port.....	Codd 6793.....	12	14
<i>K. rufa</i> Bak.....	Cathedral Peak.....	Killick 1467.....	12	15
<i>K. rigidifolia</i> E. A. Bruce.....	Machadodorp.....	Codd 8066.....	12	16
<i>K. splendida</i> E. A. Bruce.....	Magoebaskloof.....	Groeneveld s.n.....	12	17
<i>K. tysonii</i> Bak.....	Rosetta.....	Codd 8520.....	12	18
<i>K. tuckii</i> Bak.....	Fauresmith.....	Henrici s.n.....	12	19
<i>K. uvaria</i> (L.) Hook.....	Stormsvlei.....	van Breda s.n.....	12	20
<i>Notosceptrum</i> —				
<i>N. natalense</i> Bak.....	Potchefstroom.....	de Wet 392.....	12	21





## DISCUSSION.

Polyploidy is absent in the South African species of *Kniphofia*. The presence of polyploid cells in otherwise normal diploid species could give rise to viable pollen with variable chromosome numbers. These could produce individuals such as the triploid specimen of *K. snowdenii* from Uganda. Although more than 50 collections of various species of *Kniphofia* from all over the Union were studied no abnormal chromosome numbers were encountered.

Species evolution in *Kniphofia* must have taken place through point mutations and small chromosomal aberrations. This perhaps is also the reason why many collections are difficult to classify with certainty into specific units. The specific characters could become established in the newly evolved individuals through isolating mechanisms such as flowering time and geographical distribution. When the species are planted together they hybridize freely.

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# Leaf Anatomy of Six South African Grass Genera.

By

J. M. J. de Wet.

The significance of leaf anatomy in grass taxonomy was demonstrated by Duval-Jouve (1875), Pee-Laby (1898), Avdulov (1931) and Prat (1936). This paper deals with the genera *Entoplocamia* Stapf, *Fingerhuthia* Nees, *Lasiochloa* Kunth., *Plagiochloa* Adamson and Sprague, *Tetrachne* Nees and *Urochlaena* Nees. They are usually included in the Festuceae but appear to occupy an aberrant position in this tribe. Recently, Chippindall (1955) referred *Fingerhuthia* Nees to the tribe Chlorideae and the remaining five genera to the tribe Eragrosteae. Anatomical data may provide clues as to the true relationships of these genera.

## MATERIAL AND METHODS

The specimens investigated were made available by the National Herbarium, Pretoria. Anatomical slides were prepared as indicated by Prat (1948) and de Wet (1956). Root-tips were collected in the veld, fixed in Randolph's (1935) fluid, dehydrated using normal butyl alcohol as clearing agent and stained in Stockwell's (1934) solution.

## RESULTS

Anatomical, morphological and cytological observations are presented in Table 1. The leaf anatomy of *Fingerhuthia* Nees was first studied by Prat (1936) who indicated that the genus is chloroid in this respect. Moffet and Hurcombe (1949) demonstrated small chromosomes and  $2n = 20$  for *Tetrachne dregei* Nees and de Wet (1958) reported small chromosomes in *Fingerhuthia africana* Lehm. ( $2n = 40$ ) and *F. sesleriaeformis* Nees ( $2n = 20$ ). The chromosomes of *Plagiochloa uniola* (L.f.) Adamson and Sprague ( $2n = 48$ ) were found to be larger than those of the other two genera. The remaining three genera are unknown cytologically. Morphological data, although varified, are borrowed from Stapf (1900), Phillips (1951) and Chippindall (1955). The genus *Plagiochloa* was recently removed from *Demazeria* Dum. by Adamson & Sprague (1941). This new genus is closely related to *Lasiochloa* Kunth. Chippindall (1955) indicates that their distribution is similar and although the extremes in each genus are clearly distinct, there are species in both that suggest possible hybridization between them.

## DISCUSSION

The characteristics of the main subdivisions of the Gramineae have been illustrated and discussed by Stebbins (1956). It is evident that the genera studied do not belong with the tribe Festuceae. This tribe is characterized by large chromosomes, mostly in multiples of  $n = 7$ , spherical siliceous cells in an epidermis that lacks bicellular hairs and the chlorophyll tissue of the leaf is uniformly distributed throughout in the

mesophyll between the vascular bundles. The genera *Entplocamia* Stapf, *Fingerhuthia* Nees and *Tetrachne* Nees are chloridoid in all respects, except that the spikelets disarticulate below the glumes, but this characteristic is present in other typically chloridoid genera such as *Catalepis* Stapf and Stent and *Spartina* Schreb. For these reasons the classification of Chippindall (1955) who refers *Fingerhuthia* Nees to the Chlorideae and the other two genera to the Eragrosteae are justifiable. The genera *Lasiochloa* Kunth., *Plagiochloa* Adamson and Sprague and *Urochlaena* Nees, however, do not belong with either of the tribes Eragrosteae or Festuceae. Internal leaf anatomy is of the festucoid type and epidermal traits are panicoid. The chromosomes of *Plagiochloa uniola* Adamson and Sprague are larger than those of the panicoid group of grasses, but smaller than those of the festucoid group. In respect of anatomical traits, chromosome size and basic chromosome number these genera resemble members of the tribe Danthoneiae. The rhachilla, however, disarticulates below the glumes, a character not present in members of the Danthoneiae. These genera also resemble members of the Unioleae except for the relatively large chromosomes observed in *Plagiochloa uniola* Adamson and Sprague.

#### SUMMARY

Leaf anatomy was studied in six small South African grass genera. These data were correlated with cytology and spikelet morphology in an attempt to determine their phylogenetic position in the family Gramineae. The genera *Entplocamia* Stapf, *Tetrachne* Nees and *Fingerhuthia* Nees are chloridoid in respect of leaf anatomy and spikelet morphology. Cytological data from the latter two genera point to a similar conclusion. *Lasiochloa* Kunth., *Urochlaena* Nees and *Plagiochloa* Adamson and Sprague are festucoid in respect of spikelet morphology and internal leaf anatomy, panicoid in respect of epidermal traits and the latter genus resemble members of the Danthoneiae in respect of chromosome size and basic number.

#### KEY BASED ON ANATOMICAL AND MORPHOLOGICAL CHARACTERS.

1. Inner bundle sheath poorly differentiated, outer bundle sheath comprises a layer of large parenchymatous cells which contain chloroplasts, remaining chlorophyll tissue confined to a single layer of cells surrounding the vascular bundle; stomata rhomboid in shape, siliceous cells saddle-shaped, bicellular hairs club-shaped; chromosomes small,  $n = 10$ ; embryo  $\frac{1}{2}$ – $\frac{3}{4}$  as long as the grain; rhachilla disarticulates below the glumes. .... 2
- Inner bundle sheath well developed, outer bundle sheath comprises a layer of small parenchymatous cells which do not contain chloroplasts, chlorophyll uniformly distributed throughout the mesophyll between the bundles; stomata rhomboid in shape, siliceous cells dumbbell-shaped, bicellular hairs linear in shape; chromosomes relatively large,  $n = 12$ ; grain enclosed by the lemma and palea; rhachilla disarticulates below the glumes; flowers all bisexual or the uppermost gradually reduced. .... 4
2. Lower florets all bisexual, uppermost lemma subtending a male flower or empty; grain not enclosed by the lemma and palea, lodicules 2, cuneate, fleshy, nerved. .... *Fingerhuthia*
- Lower lemmas empty florets aborted, upper bisexual, uppermost subtending a male flower or palea only; grain loosely enclosed by the lemma and palea. .... 3
3. Lodicules absent. .... *Entplocamia*.
- Lodicules 2, cuneate, fleshy. .... *Tetrachne*.
4. Embryo large,  $\frac{1}{2}$  the length of the grain; lodicules 2, minute. .... *Urochlaena*.
- Embryo small, less than  $\frac{1}{2}$  the length of the grain; lodicules 2, cuneate, ciliate. .... 5
5. Spikelets 3–9-flowered, placed obliquely to the central axis. .... *Plagiochloa*.
- Spikelets 2–3-flowered, not placed obliquely to the central axis. .... *Lasiochloa*.

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# Leaf Anatomy and Morphology in South African Species of *Danthonia*.

By

J. M. J. de Wet. \*

The genus *Danthonia* is variable and this is particularly true of the South African species (de Wet, 1954a and 1956). On the basis of anatomical and morphological evidence Nevski (1934)† removed *D. glauca* Nees and *D. forskalii* (Vahl.) R. Br. from *Danthonia* to form the basis of a new genus, *Asthenatherum*. It was suggested by Hubbard (1937) that some other South African species may be equally worthy of generic rank. A new genus *Alloochaete* was described by Hubbard (1940) to include *D. andongensis* Rendle. The South African species were studied in detail in order to determine whether any other species should be removed from *Danthonia*.

## MATERIAL AND METHODS

Anatomical slides were prepared from Herbarium material as indicated by Prat (1948) and de Wet (1956). Chromosome numbers were counted in root-tip sections. Root-tips were collected in the veld, fixed in Randolph's (1935) fluid, dehydrated and sectioned as indicated by de Wet (1953) and stained in Stockwell's (1934) solution. Drawings of chromosomes and vascular bundles were made with the aid of a camera lucida.

## RESULTS

The anatomical study is confined to mature leaves. These data are presented in the form of a key in Table 1. Only the lower epidermis surface has been studied. In *D. forskalii* (Vahl.) R. Br. the siliceous cells are in the shape of short dumbbells which often appear spherical.

TABLE 1.—ANATOMICAL TRAITS

1. Chlorophyll localized around the vascular bundles; inner bundle sheath sclerenchymatous, outer bundle sheath parenchymatous; bicellular hairs present; siliceous cells dumbbell-shaped, localized above nerves; unicellular hairs form an arch over stomata. (Figs. 2 and 5).....	<i>D. forskalii</i> , <i>D. glauca</i> , <i>D. mossamedensis</i> , <i>D. suffrutescens</i> .
Chlorophyll not localized around the vascular bundles.....	2
2. Chlorophyll uniformly distributed throughout the mesophyll of the leaf (Fig. 3)...	3
Chlorophyll not uniformly distributed throughout the mesophyll of the leaf....	4
3. Inner bundle sheath sclerenchymatous.....	5
Inner bundle sheath colenchymatous.....	6
5. Outer bundle sheath composed of thin parenchyma; bicellular hairs present....	7
Outer bundle sheath composed of thick parenchyma; bicellular hairs absent....	8

\* For reading the manuscript and for his valuable suggestions, the author wishes to thank Dr. G. L. Stebbins.

† Ex, Hubbard (1937), page 135.

7. Unicellular hairs do not form an arch over the stomata..... 9
- Unicellular hairs form an arch over the stomata..... 10
9. Epidermis cells thin parenchyma; dumbbell-shaped siliceous cells localized above the nerves (Fig. 6). *D. brachyphylla*, *D. curva*, *D. macrantha*, *D. purpurea*, *D. tenella*.  
Epidermis cells thick parenchyma; spherical siliceous cells localized above the nerves (Fig. 7)..... *D. dura*, *D. stricta*.
10. Epidermis cells thick parenchyma; dumbbell-shaped siliceous cells localized above nerves..... *D. pumila*.
8. Epidermis cells thick parenchyma; halfmoon-shaped siliceous cells distributed all over the epidermis..... *D. cincta*, *D. papposa*.
6. Outer bundle sheath composed of thin parenchyma..... 11
- Outer bundle sheath composed of thick parenchyma..... 12
11. Epidermis cells thin parenchyma; bicellular hairs absent; siliceous cells, spherical, localized above nerves..... *D. lanata*, *D. lupulina*.  
Epidermis cells thick parenchyma; bicellular hairs absent; siliceous cells spherical, distributed all over the epidermis..... *D. arundinacea*.
12. Phloem divided into two groups by sclerenchymatous cells..... 13
- Phloem in one group..... 14
13. Epidermis cells thin parenchyma; bicellular hairs absent, siliceous cells spherical, localized above nerves..... *D. zeyheriana*, *D. zeyheriana* var. *trichostachya*.  
Epidermis cells thick parenchyma; bicellular hairs absent; siliceous cells spherical, distributed all over the epidermis..... *D. drakensbergensis*, *D. macowanii*.
14. Epidermis cells thick parenchyma; bicellular hairs absent, siliceous cells spherical, distributed all over the epidermis (Fig. 8)..... *D. disticha*.
4. Leaves more or less spherical; chlorophyll localized in a continuous band 3–5 layers of cells thick directly below the epidermis; mesophyll in the middle lacks chloroplasts; inner bundle sheath sclerenchymatous, outer bundle sheath composed of thin parenchyma (Fig. 1); bicellular hairs absent; epidermis cells thick parenchyma; siliceous cells spherical, localized above nerves..... *D. rangei*.

The morphology of the South African species of *Danthonia* has been discussed by Stapf (1900), Hubbard (1937) and Chippindall (1955). It will suffice to discuss the main characteristics of each group into which *Danthonia* was subdivided on the basis of anatomical traits. The species *D. mossamedensis* Rendle and *D. suffrutescens* Stapf share with *Asthenatherum* (*D. glauca* Nees and *D. forskalii* (Vahl.) R. Br.) the following prominent characteristics of external morphology. The lower culms are shortly pubescent to tomentose; innovation shoots are extravaginal; glumes strongly chartaceous, the lower distinctly 7–11-nerved and the upper 5–9-nerved; lemmas 7–10-nerved with the hairs arranged in rows between the nerves, the outer rows ending in tufts of longer hairs just below the lobes and the inner rows ending just below the insertion of the awn; lodicules 2, cuneate, nerved and glabrous; callus acute. These characteristics are also descriptive of *D. pumila* Nees, except that in the latter species the callus is obtuse. *Danthonia glauca* Nees and *D. suffrutescens* Stapf resemble each other so closely that the latter species could perhaps be regarded as a variety of *D. glauca* Nees. As indicated by Stapf (1900) they differ from each other only in two characters. The spikelets of *D. suffrutescens* Stapf are slightly larger and more acuminate than those of *D. glauca* Nees and the plant is suffrutescent with the lower sheath coriaceous. In contrast *D. glauca* Nees has smaller spikelets, is herbaceous and has a thin lower sheath. The genus *Asthenatherum* is further characterized by the panicoid type of internal leaf anatomy and epidermis.

The typical *Danthonia* species with dumbbell-shaped siliceous cells may be subdivided into three groups on the basis of external morphological traits. *Danthonia macrantha* Schrad. and *D. brachyphylla* Nees resemble *Pentameris* in superficial appearance but are more typical of *Danthonia* in spikelet morphology (Chippindall, 1955). They differ from other species of *Danthonia* conspicuously only in having two florets per spikelet and in that the hairs of the stigma bend down to join over the top of the ovary.



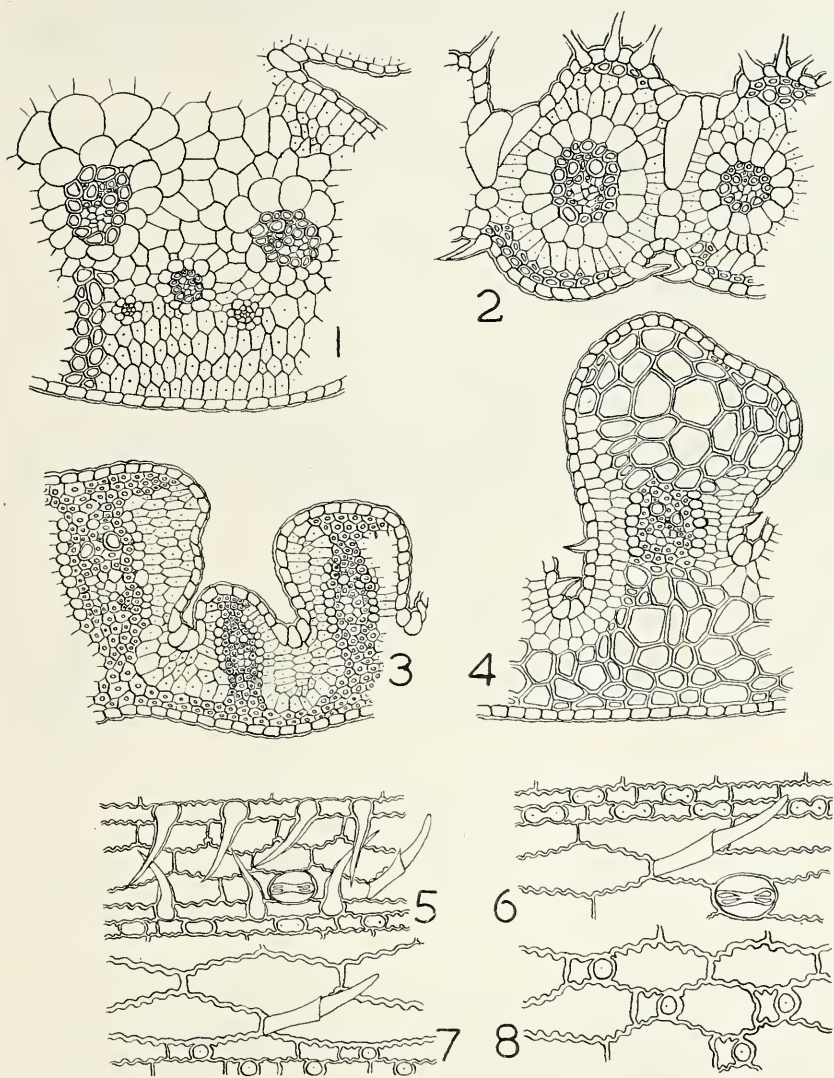


FIG. 1-4.—Internal leaf anatomy  $\times 750$ . 1. *D. rangei*; 2. *D. forskalii*; 3. *D. arundinacea*; 4. *D. cincta*.

FIG. 5-6.—Epidermis  $\times 1000$ . 5. *D. forskalii*; 6. *D. curva*; 7. *D. stricta*; 8. *D. disticha*.

Glumes that are 5-nerved; 9-nerved lemmas with a transverse fringe of tufts of long hairs below the insertion of the awn and several submarginal tufts below this fringe; distinctly 3-nerved lemma-lobes and 2 lodicules which are small, cuneate-obovate and ciliate are characteristic of *D. purpurea* Beauv. and the closely related annual *D. tenella* Nees.

*Danthonia curva* Nees with dumbbell shaped siliceous cells resemble *D. lanata* Schrad., *D. lupulina* (Thunb.) Roem. and Schult. and *D. zeyheriana* Steud. in spikelet morphology. These species have in common: glumes 3–5-nerved; lemmas 9-nerved with the hairs arranged in rows between the nerves ending just below the middle in a transverse fringe of long hairs; lobes of the lemma partly adnate to the awn; lodicules 2, obovate, ciliate, nerved.

*Danthonia cincta* Nees and *D. papposa* Nees differ from all other species of *Danthonia* in having 1–3-nerved glumes. Anatomically they are also quite distinct from other species of *Danthonia* (Figure 4). The cells between the bundles are sclerenchymatous except for two or more layers of cells along grooves of the upper epidermis. The chloroplasts are localized in these layers of parenchymatous cells.

Morphologically *D. dura* Stapf, *D. stricta* Schrad., *D. drakensbergensis* Schweick. and *D. macowani* Stapf form a natural group with the following salient features: glumes 3–5-nerved; lemmas 7–9-nerved, with the hairs variously tufted; lemma-lobes partially adnate to the awn; callus obtuse; lodicules 2, obovate, ciliated, nerved.

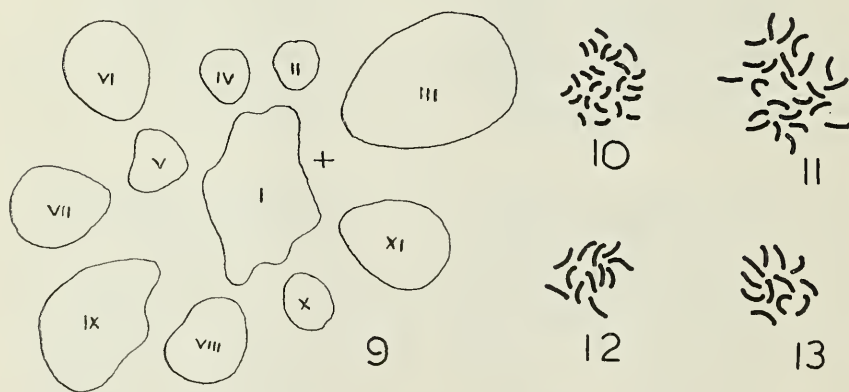


FIG. 9.—Diagram showing the relationships between species of *Danthonia*. The numbers represent groups of species as follows: Hypothetical ancestor; i. *D. curva*, *D. purpurea*, *D. tenella*; ii. *D. pumila*; iii. *Asthenatherum* (*D. forskalii*, *D. glauca*, *D. mossamedensis*, *D. suffrutescens*); iv. *D. rangei*; v. *D. arundinacea*; vi. *D. cincta*, *D. papposa*; vii. *D. lanata*, *D. lupulina*; viii. *D. dura*, *D. stricta*; ix. *D. drakensbergensis*, *D. macowanii*, *D. zeyheriana*; x. *D. disticha*, xi. *D. brachyphylla*, *D. macrantha*.

FIG. 10–11.—Chromosome numbers  $\times 3000$ . 10. *D. forskalii*, 11. *D. tenella*; 12. *D. arundinacea*; 13. *D. macowanii*.

*Danthonia arundinacea* (Berg.) Schweick. is a robust, tufted perennial with stout culms from 80 cm to more than 100 cm high; glumes 1-nerved; lemmas 7-9-nerved, villous all over and the lobes taper into a fine, short awn. *Danthonia disticha* Nees differs from all other species of *Danthonia* in having the inflorescence shaped into a distichous spike. An analysis of the spikelet reveals typical *Danthonia* characteristics. Glumes 3-nerved, lemmas 9-11-nerved, bilobed, with the hairs arranged in a tuft at the base and with a line of similar hairs on each side extending to the base of the lobes; lodicules 2, obovate, ciliated, nerved.

*Danthonia rangei* Pilger with its peculiar internal leaf anatomy resembles *Asthenatherum* in habit and superficial appearance. Spikelet morphology, however, is more typical of *Danthonia*, except that the florets are reduced to 2 per spikelet. Glumes are 3-nerved; lemmas 5-7-nerved, hairy all over, with three tufts of hairs, one each at the base of the lobes and the third at the insertion of the awn; lodicules 2, cuneate, minute; callus obtuse.

Three species, *D. macowanii* Stapf ( $2n = 12$ ), *D. arundinacea* (Berg.) Schweick. ( $2n = 12$ ) and *D. tenella* Nees ( $2n = 24$ ), were studied for the first time cytologically. A number of other species were previously studied by Calder (1937), Stebbins and Love (1941) and de Wet (1954 b). Basic chromosome numbers appear to be  $n = 6$  and  $n = 7$ . It was also indicated by de Wet (1954b) that the chromosomes of species belonging to *Asthenatherum* [*D. forskalii* (Vahl.) R. Br.] are smaller than those of more typical members of *Danthonia* (compare Figures 10-11).

## DISCUSSION.

The trends of evolutionary progress in the family Gramineae were pointed out by Stebbins (1956). From this discussion it becomes evident that the complex panicoid-eragrostoid type of epidermal traits (siliceous cells variously shaped, bicellular hairs present) and the festuoid type of chlorophyll distribution (uniformly distributed throughout the mesophyll of the leaf), are the more primitive leaf anatomical characters. Members of the genus *Danthonia* exhibit a combination of primitive and advanced anatomical traits.

The known diploid species are confined to southern Africa. On the basis of stomatal size it would appear as if these, *D. curva* Nees, *D. disticha* Nees, *D. arundinacea* (Berg.) Schweick. and *D. macowanii* Stapf, are the only diploid representatives of the genus. The stomata of these species vary in size from  $23-30 \mu$  to  $25.00 \mu$ . Other species with relatively small stomata are present in South America: *D. lechleri* Steud. ( $26.40 \mu$ ) and *D. secundiflora* Presl. ( $27.60 \mu$ ), but they resemble in stomatal size the known tetraploid species *D. tenella* Nees ( $26-30 \mu$ ) and *D. purpurea* Beauv. ( $26.40 \mu$ ) more closely (de Wet, 1954b).

The known diploids exhibit the primitive type of chlorophyll distribution. The epidermis is of the primitive type in *D. curva* Nees, but more advanced (bicellular hairs are absent and the siliceous cells are spherical) in the remaining three diploids. The lemma-lobes are well developed in these diploids, with the lemmas hairy all over in *D. arundinacea* (Berg.) Schweick. and variously tufted and fringed in the others.

In respect of spikelet morphology the North American species, together with some from South America and the European species, *D. calycina* Roem. and Schult., appear to be the most primitive. These are characterized by relatively poorly developed lemma-lobes and lemmas are hairy along the margins only, or also sparsely so on the back. The North American species with these characteristics are hexaploids ( $2n = 36$ ) according to Stebbins & Love (1941). South American species which exhibit these primitive floral characteristics: *D. chilensis* Desv. has  $2n = 36$ , *D. oresigena* Phil.

has  $2n = 48$ , *D. cirrata* Hack. and Arech. has  $2n = 72$  and the remaining species *D. malacantha* (Steud) Pilger, *D. montana* Doell., *D. montevidensis* Hack. and Arech., *D. secundiflora* Presl. and *D. tandilensis* Kotze are unknown cytologically. All these presumed primitive species are characterized by an epidermis with dumbbell-shaped siliceous cells and linear bicellular hairs. The chlorophyll is uniformly distributed throughout the mesophyll of the leaf and the outer bundle sheath is parenchymatous.

From this discussion it would appear as if the most primitive characters exhibited by present day species of *Danthonia* are as follows: Lemma-lobes poorly developed; hairs on the lemma not tufted or fringed and confined to the margins and the back; inner bundle sheath of the vascular bundles of the leaf sclerenchymatous, outer bundle sheath composed of parenchymatous cells; chlorophyll uniformly distributed throughout the mesophyll of the leaf; epidermis with dumbbell-shaped siliceous cells and linear bicellular hairs. No South African species exhibit all of these assumed primitive characters.

Two dominant lines of phylogenetic specialization are evident in the South African species of *Danthonia*. The first line gave rise to the genus *Asthenatherum*. The latter genus is regarded in this discussion to include the following species: *D. forskalii* (Vahl.) R. Br., *D. glauca* Nees, *D. mossamedensis* Rendle and *D. suffrutescens* Stapf. Morphologically they resemble the more typical species of *Danthonia* in many respects (Hubbard, 1937). Anatomically they retained the primitive epidermal characters but became specialized in respect of chlorophyll distribution. Only one of these species, *D. forskalii* (Vahl.) R. Br. is known cytologically, but it has been pointed out by de Wet (1954b) that although the basic chromosome number is, as in *Danthonia*,  $n = 6$  or 12 the chromosomes are significantly smaller than those of typical representatives of *Danthonia*. It is of interest to note that all the species here included in *Asthenatherum* are adapted to grow exclusively in dry sandy areas. The second line of phylogenetic development retain the primitive type of chlorophyll distribution, but the outer bundle sheath became sclerenchymatous, bicellular hairs are absent from the epidermis and the siliceous cells are spherical. This group includes the species *D. disticha* Nees, *D. drakensbergensis* Schweick., *D. macowanii* Stapf and *D. zeyheriana* Steud. Three more species, *D. lanata* Schrad., *D. lupulina* (Thunb.) Roem. and Schult., and *D. arundinacea* (Berg.) Schweick., resemble the above species in leaf anatomical characters except that the outer bundle sheath is parenchymatous.

*Danthonia stricta* Schrad. and *D. dura* Stapf combine in their epidermis a peculiar combination of primitive and advanced characters. The siliceous cells are spherical, but linear bicellular hairs are always present.

Three species with the festucoid type of epidermal traits appear to represent specialized lines of development in respect of internal leaf anatomy. The chlorophyll bearing tissue is localized but not as in the highly developed panicoid type. These are *D. rangei* Pilger on the one side and *D. cincta* Nees and *D. papposa* Nees on the other side.

Among the species which retained the primitive type of epidermal traits, *D. brachyphylla* Nees and *D. macrantha* Schrad. exhibit a reduction in the number of fertile florets to two per spikelet. In these species the glumes are much enlarged and could serve as a means of seed dispersal.

The relationships of the species groups into which *Danthonia* may be subdivided on the basis of leaf anatomical and morphological characters are indicated in Figure 9. The actual connections between the species will only be known after a complete cytogenetical study of the genus has been undertaken. For this reason the type of diagrammatic presentation discussed by Stebbins (1956) has been adopted.



The various theories about centre of origin and plant migration have been discussed by Cain (1944). Although the greatest concentration of species is found in the south western tip of Africa, it would appear as if the genus migrated from the North. The species *D. calycina* Roem. and Schult. from Eastern Europe was shown to have retained many primitive characters and could perhaps be regarded as a relic. The tropical African species are characterized by the primitive type of anatomical characters and could perhaps be regarded as relics which have adapted themselves to their mountain existence in a tropical climate.

Small colonies of one or more species are also localized along the mountain ranges of the summer rainfall areas of southern Africa with a greater concentration of species in the winter rainfall area. The genus *Asthenatherum* extends from south east Asia into North Africa and along the arid areas of the west coast to South Africa. The presence of a species like *D. pumila* Nees along the arid west coast of South Africa is difficult to explain. As was pointed out earlier, this species resembles *Asthenatherum* very closely except for chlorophyll distribution of the leaf. In this respect it appears to form a direct link between *Danthonia* and *Asthenatherum*. If this species were present in south eastern Asia or North Africa it could have been regarded as a left-over of the original *Asthenatherum* type. Its presence in South Africa could be explained in any one of many ways. The most obvious although unlikely explanation is that *Asthenatherum* originated in South Africa, with *D. pumila* Nees forming a direct link between *Danthonia* and *Asthenatherum*. It is also possible that *D. pumila* Nees represents such a link and migrated south with *Asthenatherum*. It could also be regarded as a specialized line of development from *Asthenatherum*. The latter statement is hardly likely because it is difficult to imagine that the advanced type of chlorophyll distribution should change back to the more primitive one, especially as there is no obvious advantage in such a process. Another possibility is that *D. pumila* Nees represents a hybrid between a species of *Asthenatherum* and *Danthonia* or some other closely related genus. To the author the most likely explanation appears to be that *D. pumila* Nees represents a specialized line of phylogenetic development which came about after *Danthonia* had reached South Africa. It would appear as if the genera *Danthonia* and *Asthenatherum* had their origin in a common ancestor. The latter genus, being better adapted to dry conditions migrated south along the arid regions of the west coast of Africa. *Danthonia* migrated along the mountain ranges of the tropics and subtropics to reach the winter rainfall area of southern Africa.

## SUMMARY

Leaf anatomy and morphology of the South African species of *Danthonia* were studied in detail. These data were correlated to trace the relationships of species. The problem of what is primitive and what is advanced has been related to leaf anatomy. Species with a combination of the panicoid type of epidermis and the festucoid type of internal leaf anatomy appear to represent the more primitive types. The possible direction of migration of the South African species of *Danthonia* was discussed. The chromosome numbers of *D. macowanii* Stapf ( $2n = 12$ ), *D. arundinacea* (Berg.) Schweick. ( $2n = 12$ ) and *D. tenella* Nees ( $2n = 24$ ) are reported for the first time. Three species, *D. mossamedensis* Rendle, *D. pumila* Nees and *D. suffrutescens* Stapf should be transferred to *Asthenatherum*. The latter species could be regarded as a variety of *A. glauca* (Nees) Nevski.

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# Culm Anatomy in Relation to Taxonomy.

By

J. M. J. de Wet.

The problem of phylogenetic relations is not always to be solved by a study of external characters only. This is particularly true in the family Gramineae. A survey of characters that are useful in the classification of the grasses is presented by Stebbins (1956). During an investigation of anatomical characters in *Danthonia* it was noted that those species which could be referred to *Asthenatherum* Nevski differ from typical representatives of *Danthonia* in culm anatomy. These two species-groups also differ from each other in leaf anatomy (de Wet, 1954). To test the taxonomic significance of this character, a representative group of grasses from different tribes were studied.

## MATERIAL AND METHODS

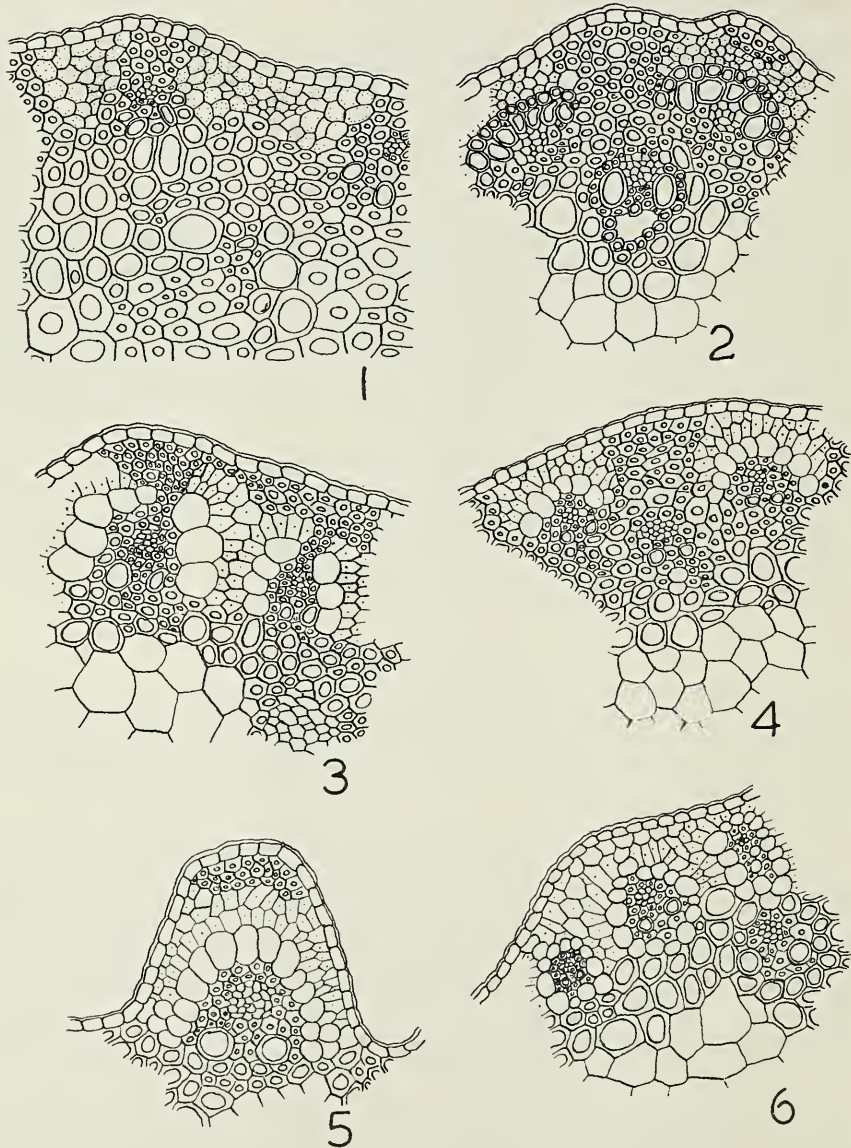
Specimens studied were obtained from the National Herbarium, Pretoria. Pieces of the culm taken just below the inflorescence were placed in a softening medium consisting of equal parts 50 per cent ethyl alcohol and glycerol for 24 hours. Sections were cut by hand and stained in a 1 per cent aqueous safranin solution. Drawings were made with the aid of a camera lucida.

## RESULTS

The genera studied are listed in Table 1. Two or more species of each genus were investigated. The concepts of tribes are similar to those of Avdulov (1931), Prat (1936) and Chippindall (1955). Leaf anatomical data are mostly from Avdulov (1931) and Prat (1936). The letters F (festucoid), E (eragrostoid-chloridoid), P (panicoid) and B (bambusoid) refer to the types of characters discussed and illustrated by Stebbins (1956).

Sections were cut transversely through the stem at about 1 cm below the inflorescence. Below the epidermis a more or less continuous circular layer of sclerenchyma and collenchyma is present, carrying bundles which are solitary or in pairs. Other bundles lay irregularly scattered in the pith. The bundles included by this circular sclerenchymatous strand are usually connected with the epidermis by a strand of collenchyma cells. The chlorenchyma is entirely situated between these strands and the epidermis. In other words, these small vascular bundles are always girdered by chlorenchyma cells. The layer of chlorenchyma cells directly bordering onto the vascular bundle usually distinguish themselves clearly by their size from the rest of the chlorenchyma. It is this layer of cells (bundle sheath) that appears to be of use in grass taxonomy.

In the festucoid group of grasses; tribes Festuceae, Brachypodieae, Hordeae, Aveneae, Phalarideae and Agrostaeae this parenchymatous bundle sheath is poorly differentiated and can not be distinguished from the rest of the chlorenchymatous tissue (Fig. 1). This is also true in genera studied belonging to the tribes Oryzeae, Ehrharteae and Danthonieae (except for the genus *Asthenatherum*). This type of anatomical character was also observed in the genera *Lasiochloa*, *Plagiochloa* and *Urochlaena* which Chippindall (1955) refer to the tribe Eragrostae.



In the cragrostoid-chloridoid group of grasses (Zoiseae, Eragrosteae, Chlorideae and Sporoboleae) the parenchymatous bundle sheath is composed of very large cells (Figs. 3 and 4). This bundle sheath is also obvious in the Paniceae, Arundinelleae



and the Andropogoneae (Figs. 5 and 6) but the individual cells are often not quite as large as is the case in the eragrostoid-chloridoid group. This is also true in representatives of the tribes Meliceae, Arundineae, Pappophoreae and the genus *Stipa*.

The genus *Aristida* is quite distinct from all the other grasses studied. A very obvious internal bundle sheath of sclerenchyma is present, surrounded by a parenchymatous sheath of smaller cells, which often are also thickened and apparently lack chlorophyll (Fig. 2).

TABLE 1.—Anatomical characteristics.\*

Genus.	Culm anatomy.	Leaf anatomy.	Epid.
<i>Oryzeae</i> —			
<i>Oryza</i> .....	1	F	B
<i>Potamophila</i> .....	1	F	B
<i>Ehrharteae</i> —			
<i>Ehrharta</i> .....	1	F	B
<i>Meliceae</i> —			
<i>Melica</i> .....	2	F	P
<i>Arundineae</i> —			
<i>Phragmites</i> .....	2	P	P
<i>Pappophoreae</i> —			
<i>Enneapogon</i> .....	3	P	E
<i>Schmidtia</i> .....	2	P	E
<i>Danthonieae</i> —			
<i>Asthenatherum</i> .....	3	P	P
<i>Chaetobromus</i> .....	1	F	P
<i>Danthonia</i> .....	1	F	F-P
<i>Pentameris</i> .....	1	F	F
<i>Pentaschistis</i> .....	1	F	F-P
<i>Poa</i> .....	1	F	P
<i>Stipeae</i> —			
<i>Aristida</i> .....	4	P	P-F
<i>Stipa</i> .....	2	F	F
<i>Festuceae</i> —			
<i>Briza</i> .....	1	F	F
<i>Festuca</i> .....	1	F	F
<i>Poa</i> .....	1	F	F
<i>Vulpia</i> .....	1	F	F
<i>Brachypodieae</i> —			
<i>Brachypodium</i> .....	1	F	F
<i>Bromus</i> .....	1	F	F
<i>Hordeae</i> —			
<i>Elymus</i> .....	1	F	F
<i>Aveneae</i> —			
<i>Avena</i> .....	1	F	F
<i>Helictotrichon</i> .....	1	F	F
<i>Holcus</i> .....	1	F	F
<i>Koeleria</i> .....	1	F	F
<i>Phalarideae</i> —			
<i>Phalaris</i> .....	1	F	F
<i>Agrosteae</i> —			
<i>Agrostis</i> .....	1	F	F
<i>Calamagrostis</i> .....	1	F	F
<i>Zoiseae</i> —			
<i>Tragus</i> .....	3	P	E
<i>Mosdenia</i> .....	3	P	E
<i>Monelytrum</i> .....	3	P	E
<i>Perotis</i> .....	3	P	E

\* In culm anatomy: Type 1—parenchymatous sheath not obvious; type 2—sheath cells small; type 3—sheath cells extremely large; type 4—*Aristida*. In leaf anatomy and epidermis: F—festucoid; E—eragrostoid-chloridoid; P—panicoid; B—bambusoid types.

Genus.	Culm anatomy.	Leaf anatomy.	Epid.
<i>Eragrosteae</i> —			
Diplachne.....	3	P	E
Dinebra.....	3	P	E
Eragrostis.....	3	P	E
Entoplocamia.....	3	P	E
Lophacme.....	3	P	E
Leptocarydion.....	3	P	E
Lasiachloa.....	1	F	P
Odyssea.....	3	P	E
Plagiachloa.....	1	F	P
Pogonarthria.....	3	P	E
Stiburus.....	3	P	E
Tetrachne.....	3	P	E
Trichoneura.....	3	P	E
Triraphis.....	3	P	E
Tripogon.....	3	P	E
Urochlaena.....	1	F	P
<i>Chlorideae</i> —			
Cynodon.....	3	P	E
Chloris.....	3	P	E
Ctenium.....	3	P	E
Eustachys.....	3	P	E
Fingerhuthia.....	3	P	E
Harpechloa.....	3	P	E
Microchloa.....	3	P	E
Oropetium.....	3	P	E
Rendlia.....	3	P	E
<i>Arundinelleae</i> —			
Arundinella.....	2	P	P
Danthoniopsis.....	2	P	P
Loudetia.....	2	P	P
Tristachya.....	2	P	P
Trichopteryx.....	2	P	P
<i>Paniceae</i> —			
Antheophora.....	2	P	P
Alloteropsis.....	2	P	P
Acroceras.....	2	P	P
Brachiaria.....	3	P	P
Cenchrus.....	2	P	P
Digitaria.....	2	P	P
Eriochloa.....	2	P	P
Echinochloa.....	3	P	P
Melinis.....	2	P	P
Oplismenus.....	2	P	P
Panicum.....	2	P	P
Paspalum.....	2	P	P
Rhynchelytrum.....	2	P	P
Setaria.....	2	P	P
Tricholaena.....	2	P	P
Urochloa.....	2	P	P
<i>Andropogoneae</i> —			
Andropogon.....	2	P	P
Bothriochloa.....	2	P	P
Chrysopogon.....	2	P	P
Diectomis.....	2	P	P
Elyonurus.....	2	P	P
Hyparrhenia.....	2	P	P
Heteropogon.....	2	P	P
Hemarthria.....	2	P	P
Ischaemum.....	2	P	P
Imperata.....	2	P	P

Genus.	Culm anatomy.	Leaf anatomy.	Epid.
Monocymbium.....	2	P	P
Miscanthidium.....	2	P	P
Sehima.....	2	P	P
Sorghum.....	2	P	P
Themeda.....	2	P	P
Trachypogon.....	2	P	P
Urelytrum.....	2	P	P

## DISCUSSION

Comparing the anatomical data presented in Table I, it becomes evident that there is a close correlation between stem anatomy and leaf anatomy. The data have little value as such, but only supply another tool in studying grass phylogeny. Other characters which were proved to be useful in the taxonomy of the Gramineae are leaf anatomy (Duval-Jouve, 1875, Avdulov, 1931); histology of the epidermis (Prat, 1936); Cytology (Avdulov, 1931); embryo anatomy (Reeder, 1957); root-hair development (Row and Reeder, 1957); physiology (Harz, 1880, Cugnac, 1931, Al-Aish, 1956) and organization of the shoot apex (Brown, Heimsch and Emery, 1957.)

The data from stem anatomy further emphasize the difference in phylogenetic affinities between *Aristida* and *Stipa*. A further difference between *Danthonia* and *Asthenatherum* also becomes evident. In this respect *Danthonia* resembles the festucoid group and *Asthenatherum* the panicoid group of grasses. These anatomical data also show that the genera *Lasiachloa*, *Plagiochloa* and *Urochlaena* occupy an aberrant position in the tribe Eragrosteae.

## SUMMARY

The culm was sectioned transversely about 1 cm. below the inflorescence. The bundles closest to the epidermis are flanked by parenchymatous cells which contain chloroplasts. Directly against the bundle these cells arrange themselves into a parenchymatous sheath which may be poorly differentiated or well developed and composed of small or large cells. It was pointed out that these anatomical data show a close correlation with data from leaf anatomy.

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# Notes on the Sapotaceae of Southern Africa.

By

A. D. J. Meeuse.

## INTRODUCTION.

In view of the proposed "Flora of Southern Africa", the Sapotaceae of the area were studied. It soon became apparent that several South African species also occur in tropical Africa or are closely related to tropical species, and this necessitated the study of material from adjoining regions such as Angola, Rhodesia and Portuguese East Africa. Several species not recorded from the Union, but found in neighbouring areas are included in this treatment, either because they may be recorded later, or because they were interesting in connection with related South African forms.

This revision is mainly based on material from herbaria in Southern Africa. Several problems that could not be solved in this country were passed on to our officer stationed at Kew, Mr. B. de Winter. My thanks are due to Mr. de Winter, not only for his valuable assistance with taxonomical problems, such as comparing of type specimens and other material at Kew and in the British Museum (Nat. Hist.), but also for his kind help in obtaining abstracts of several publications which were not available here. Without his contribution many minor difficulties and doubtful points could never have been satisfactorily cleared up.

The material of the National Herbarium Pretoria, was studied and, in addition, material was kindly sent on loan by the following herbaria (abbreviations are, where possible, those of the latest Index Herbariorum by Lanjouw and Stafleu): BOL, COI, GRA, J, L, LM, NBG (including SAM), NH, NU, PRE (including TRV), SRGH; and Forestry Department Herbarium, Pretoria (SAFD).

## HISTORY OF THE STUDY OF SAPOTACEAE IN SOUTHERN AFRICA.

The first comprehensive work, De Candolle's *Prodromus* Vol. 8 (1844) only mentions two species from Southern Africa, viz., *Sideroxylon inerme* L. and *Mimusops caffra* E. Mey. ex A. DC. Until the publication of Engler's monograph of all the African Sapotaceae in his series "Monographien Afrikanischer Pflanzenfamilien und Gattungen", Vol. 8 (1904)—cited in the following pages as "Mon. Sapot. Afr."—the study of Sapotaceae in Southern Africa was restricted to occasional descriptions of new species such as by Sonder in *Linnaea* 23 (1850) and by N. E. Brown in *Kew Bull.* 1895.

The Sapotaceae of tropical Africa were treated by Baker in *Flora of Tropical Africa* 3 (1877), but only very few of the species mentioned extend into South Africa.

In 1906 the family was treated in *Flora Capensis*, Vol. 4 (1), by C. H. Wright, whose account was partly based on unpublished notes left by Harvey. This treatment added very little to Engler's monograph and is not critical, in fact, most descriptions are practically literal translations of those given by Engler. Phillips, in *Genera S. Afr. Flow. Pl.* ed. 1 (1926), recognised three genera, viz. *Sideroxylon* (with 2 species in S. Africa), *Chrysophyllum* (3 spec.) and *Mimusops* (11 species). In the second edition

of the Genera (1951), Phillips maintains the same 3 genera with 2, 3, and 12 species respectively. As will be pointed out later, his conception of the Sapotaceae genera cannot be maintained and more genera have to be recognised if present trends are accepted. The late Father J. Gerstner, finally, treated the family in two papers which are rather superficial as far as systematics and nomenclature are concerned, but most valuable on account of important field-notes; cf. J. S. Afr. Bot. 12: 47-55 (1946), and 14: 171-174 (1948). Gerstner's work has clarified the status of *Clrysophyllum wilmsii* Engl. and of *Mahea natalensis* Pierre (= *Mimusops natalensis* Engl. non Schinz). He recognised 5 genera. The following Table gives a comparative analysis of the species mentioned in the more comprehensive publications and the present author's interpretation (Cf. Table I).

#### DELIMINATION OF THE GENERA,

The genera of Sapotaceae are not very sharply defined and the modern monographers are inclined to "moderate splitting", which trend is followed here. For a more detailed account of the history of the generic taxonomy and of the various systems of classification, see Baehni, Candollea 7: 394-508 (1938).

The most recent systems of classification are those published by Baehni (l.c.) and by Lam (Occ. Papers. Bern. P. Bishop Mus. Honolulu 14, no. 9: 137-141 (1938), and Rec. Trav. Bot. Néerl. 36: 524 (1939). Although these two systems are basically entirely different, these authors agree in several essential points and in the delimitation of most genera. The most important feature of the most recent classifications, as far as the S. African representatives are concerned, is the segregation of the several genera from the large and heterogeneous genus *Mimusops sensu* Engler (1904), such as *Manilkara*, *Muriea*, *Lecomtedoxa*, *Baillonella* and others.

In this revision many more genera are accepted than was done by Phillips in his "Genera", but it is considered preferable to follow modern monographers of the family rather than one general, and consequently unspecialized, reference work.

#### FAMILY CHARACTERS.

Trees often attaining a large size or sometimes shrubs, occasionally climbing, containing latex ducts in all parts (even the fruits). *Leaves* alternate, almost invariably petiolate, undivided and usually with entire margin, often more or less leathery; stipules often present but usually early deciduous, setaceous or linear-subulate. *Flowers* axillary but often on older branches or stems, generally solitary or fascicled, sessile or pedicelled, regular, almost invariably bisexual, usually small but often fragrant. *Calyx* consisting of one or two whorls of free or nearly free sepals, usually with a rusty-brown pubescence on the outside; sepals 2-5, occasionally more, in each whorl, usually entire, often firm to coriaceous. *Corolla* gamopetalous, usually cream or white and almost invariably glabrous, consisting of a tube and one or two whorls of 2-5 or occasionally more lobes; the tube usually cylindric to campanulate, usually short; the lobes imbricate, entire or occasionally fringed, in several genera each lobe bearing two lateral petaloid appendages of various sizes, sometimes nearly as large as the lobe itself, sometimes much smaller. *Alternipetalous staminodes* as many as there are petals in one whorl, or fewer, or absent, varying from rather large and petaloid to small and scale-like, entire, or variously fringed, lobed or dissected, glabrous or hairy. *Epipetalous staminodes* sometimes present, but if so they are transformed, sterile or abortive stamens and often resemble the latter in shape. *Stamens* in one or two whorls (occasionally in more whorls, not in Southern Africa), as many per whorl as the number of corolla-lobes or twice as many or fewer, inserted in the mouth of the corolla-tube or sometimes lower down; filaments usually present but generally short; anthers 2-theous; thecae usually extrorse, dehiscing with longitudinal slits. *Ovary* usually



TABLE I.—THE SAPOTACEAE OF SOUTHERN AFRICA (COMPARATIVE ANALYSIS)

Author. Genus.	A.DC., Prodr. VIII (1844).	Baker in Fl. Trop. Afr. III (1877).	Engler, Mon. Afr. Pfl. fam. u. Gattungen, VIII., Sapot. (1904).	C. H. Wright in Fl. Cap. IV, 1 (1906).	J. Gerstner in J. S. Afr. Bot. 12 (1946) and 14 (194 )	Present revision.
Sideroxylon.....	Sideroxylon inerme L.	— Sideroxylon diospyroides Baker.	Sideroxylon inerme L. Sideroxylon diospyroides Baker	Sideroxylon inerme L. Sideroxylon Randii Sp. Moore	Sideroxylon inerme L. — (Not mentioned)	Sideroxylon inerme L. = Sideroxylon inerme. = Pouteria magalismontana.
Chrysophyllum.....		Chrysophyllum magalismontanum Sond.	Chrysophyllum magalismontanum Sond. Chrysophyllum natalense Sond. Chrysophyllum Wilmsii Engl. Chrysophyllum argyrophyllum Hiern Chrysophyllum antunesii Engl. Chrysophyllum carvalhoi Engl. Chrysophyllum gorungosanum Engl.	Chrysophyllum magalismontanum Sond. Chrysophyllum natalense Sond. Chrysophyllum Wilmsii Engl.	Chrysophyllum magalismontanum Sond. Chrysophyllum natalense Sond. — Chrysophyllum magalismontanum	= Pouteria magalismontana (Sond.) A. Meeuse = Pouteria natalensis (Sond.) A. Meeuse = Pouteria magalismontana. = Pouteria magalismontana. = Pouteria magalismontana. = Pouteria magalismontana. Chrysophyllum gorungosanum Engl. Chrysophyllum viridifolium Wood et Franks
Pouteria.....		(Under Chrysophyllum) (Sideroxylon brevipes Baker)	(Chrysophyllum) (Chrysophyllum) Pachystela brevipes (Baker) Engl. Pachystela cinerea (Engl.) Pierre	(Chrysophyllum) (Chrysophyllum)	(Chrysophyllum magalismontanum) (Chrysophyllum natalense)	Pouteria magalismontana (Sond.) A. Meeuse Pouteria natalensis (Sond.) A. Meeuse Pouteria brevipes (Baker) Baehni = Pouteria brevipes.
Vincentella.....						Vincentella sapinii (De Wild). Brenan
Mimusops.....	Mimusops caffra E. Mey. ex A.DC.	— Mimusops kirkii Baker Mimusops moehisia Baker	Mimusops caffra E. Mey. ex A.DC. Mimusops kirkii Baker Mimusops moehisia Baker Mimusops obovata Sond. Mimusops woodii Engl. Mimusops oleifolia N.E.Br. Mimusops zeyheri Sond. Mimusops densiflora Engl. Mimusops menyhartii Engl. Mimusops fischeri Engl. Mimusops zanzibarensis Engl. Mimusops marginata N.E.Br. Mimusops schinzii Engl. Mimusops dispar N.E.Br. Mimusops discolor (Sond.) Hartog Mimusops natalensis (Pierre) Engl. Mimusops henriquesii Engl. et Warb.	Mimusops caffra E. Mey. ex A.DC. — Mimusops obovata Sond. Mimusops woodii Engl. Mimusops oleifolia N.E.Br. Mimusops zeyheri Sond. — — — Mimusops marginata N.E.Br. Mimusops schinzii Engl. Mimusops dispar N.E.Br. Mimusops discolor (Sond.) Hartog Mimusops natalensis (Pierre) Engl. — Mimusops concolor Harv. ex Wright	Mimusops caffra E. Mey. Mimusops kirkii Baker Mimusops moehisia (1946) — Manilkara moehisia (1948) Mimusops obovata Sond. — Mimusops obovata — Mimusops obovata Mimusops zeyheri Sond. — — — Mimusops marginata N.E.Br. Mimusops schinzii Engl. (Not mentioned) — Labourdonnaisia discolor — Labourdonnaisia discolor “ Mimusops Henriquesiana Sim ” Mimusops concolor (1946) — Manilkara concolor (1948)	Mimusops caffra E. Mey. ex A.DC. = Mimusops zeyheri. = Manilkara moehisia. Mimusops obovata Sond. = Mimusops obovata. = Mimusops obovata. Mimusops zeyheri Sond. = Manilkara moehisia. = Manilkara moehisia. = Manilkara spec. (M. moehisia?). = Manilkara zanzibarensis. Austromimusops marginata. Austromimusops marginata. Austromimusops dispar. Muriea discolor. = Muriea discolor. = Lecomtedoxa henriquesii. = Manilkara concolor.
Austromimusops.....			(Mimusops marginata) (Mimusops dispar)	(Mimusops marginata) (Mimusops dispar)	(Mimusops marginata) —	Austromimusops marginata (N.E.Br.) A. Meeuse. Austromimusops dispar (N.E.Br.) A. Meeuse. Austromimusops sylvestris (Sp. Moore) A. Meeuse.
Manilkara.....		(Mimusops moehisia Baker)	(Mimusops moehisia) (Mimusops zanzibarensis)	— — (Mimusops concolor)	“ Manilkara moehisia (Baker) Gerstn.” “ Manilkara concolor (E. Mey.) Gerstn.”	Manilkara moehisia (Baker) Dubard Manilkara zanzibarensis (Engl.) Dubard Manilkara concolor (Harv.) Gerstn. Manilkara macaulayae (Hutch. et Corb.) H. J. Lam
Muriea.....			(Mimusops discolor) (Mimusops natalensis)	(Mimusops discolor, Mimusops natalensis)	Labourdonnaisia discolor Sond.	Muriea discolor (Sond.) Hartog
Lecomtedoxa.....			(Mimusops henriquesii)		(Mimusops henriquesiana Sim)	Lecomtedoxa henriquesii (Engl. et Warb.) A. Meeuse

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5- to many-locular with a single ovule in each locule; style cylindric or more or less conical or subulate, ending in an acute or capitate stigma; ovary superior, often rusty-pubescent. *Fruit* a berry with a usually thin outer layer and a juicy or mealy, rarely tough and leathery pulp in which the seeds are embedded. *Seeds* as many as there are ovules or fewer, compressed or tumid; testa either hard ("bony") and in this case usually smooth and shiny, or leathery to crustaceous and in this case often dull, with an attachment area (cicatrix or "scar") containing the hilum; cicatrix basal or lateral, small and circular or large, sometimes covering about half the surface area of the seed, of a different texture (duller and rougher than the testa and usually thinner and softer); endosperm either copious and found on either side of the flat foliaceous cotyledons, or scanty to absent and in this case the cotyledons thick and fleshy.

An almost completely tropical family comprising over 600 described species in a number of genera which are very difficult to define, because there is hardly any other family of the Phanerogams where the characters integrate and overlap to such an extent. For this reason the number of "genera" varies from author to author, some recognising about a dozen, others up to 120, but following present trends about 40 genera can be recognised. Another difficulty is that genera which appear to be rather sharply defined in one area may show intermediates in another region of the world and only a world-wide study can reveal the relationships. Several genera are already known to occur in more than one continent (*Pouteria* and *Manilkara* are circumtropical, *Mimusops* occurs in Africa and tropical Asia, *Chrysophyllum* is found in America and Africa and possibly occurs in Asia as well) and more similar links may be found.

#### Key to the genera.

As the genera of Sapotaceae are not very sharply defined, and both characters of the flower and the seed are used in their classification, the following key will not always lead direct to the proper genus if only flowers or only fruits are available, but the alternatives are indicated. Two characters used in the key need some explanation. In several genera the corolla-lobes occur in groups of three. The generally adopted conception is that each corolla-lobe, which is the central one of each group of three, bears two "lateral (or dorsal) appendages" which are often interpreted as stipules. Only Gilly [in Trop. Woods 73 (1934), p. 1-22] developed a different theory, viz., that in genera such as *Mimusops* and *Manilkara* the biseriate calyx of most authors represents the calyx and the corolla, the inner whorl being the true corolla, whereas the corolla of other authors is interpreted as an outer whorl of staminodes. It is not very likely that Gilly's views will be generally adopted, because there are genera having a *monoseriate* calyx and corolla-lobes with lateral appendages (*Bumelia*). The African genus *Lecomtedoxa* often shows sub-biseriate calyces and corolla-lobes with small lateral appendages and forms a link between the groups with biseriate calyces and (mostly) lateral appendages to the corolla-lobes (included by Lam in his subfamily *Mimusoideae*) and the groups with mostly monoseriate calyces and usually without lateral appendages (Lam's *Sideroxyloideae-Pouteriinae*).

The other character used is the "scar" or cicatrix of the seed (*area derasa* of Baehni). The part of the testa by which the seed is or was attached to the inside of original loculum of the ovary is usually very distinct from the rest of the testa by a paler colour, a less smooth surface, a surrounding rim, location in a depression of the seed, etc. The shape and size of this area form a very good distinguishing character.

Flowers generally 5-merous; sepals in one whorl or at least never manifestly biseriate; lateral appendages to the corolla-lobes absent (only in *Lecomtedoxa* present);

Corolla-lobes without lateral appendages; flowers rather strictly 5-merous throughout:

Berry globose, 1-seeded; seed depressed-globose, bluntly 4- or 5-angled or somewhat ribbed, with a small circular cicatrix; alternipetalous staminodes always as many as the corolla-lobes and about as long, petaloid, usually triangular to lanceolate from a broad base; corolla-lobes not strongly reflexed. . . . 1. *Sideroxylon*.

- Berry usually ovoid to oblong; seed ellipsoid, ovoid or oblong, not angular or somewhat ribbed, with a lateral, usually long and sometimes very large scar:
- Fruits usually 3-5-seeded; seeds laterally compressed with a hard, shiny bony testa and narrow linear scar; endosperm copious, cotyledons thin and foliaceous; alternipetalous staminodes O (if fruit lacking and staminodes O, see also 3. *Pouteria*)..... 2. *Chrysophyllum*.
- Fruits usually 1-seeded, sometimes 2-seeded; seeds usually not much compressed, with a thin, more crustaceous testa; scar linear or very large and occupying the ventral half of the seed; endosperm O, cotyledons thick and fleshy; alternipetalous staminodes 1-5, or absent:
- Corolla-tube short but distinct; petals not strongly reflexed; filaments rather short and stoutish, stamens therefore not or but slightly exerted; ovary in flower not conspicuous..... 3. *Pouteria*.
- Corolla-tube very short to almost O; petals completely reflexed; filaments long and slender, erect and hence stamens almost completely exerted; ovary exposed, comparatively large and conspicuous..... 4. *Vincentella*.
- Corolla-lobes with lateral appendages; whorls of flower 3-6-merous; alternipetalous staminodes present, as many as the corolla-lobes; fruit large ( $\pm$  4 cm. by 2-2.5 cm.), 1-seeded, with an oblong large lateral scar; seed without endosperm..... 5. *Lecomtedoxa*.
- Flowers generally 3-4-merous, sepals always distinctly biseriate, corolla-lobes usually each with 2 petaloid lateral appendages, very rarely appendages small or O:
- Flowers generally 4-merous; alternipetalous staminodes more or less lanceolate, entire (except sometimes their tips), hairy outside; lateral appendages of the corolla-lobes always well-developed:
- Seed ellipsoid, not or but slightly laterally compressed, with a pergamaceous or crustaceous, not very shiny or quite dull testa and a large scar occupying most of the ventral half of the seed; endosperm O, cotyledons thick and fleshy; leaves distinctly crowded at the ends of the branches, usually not coriaceous nor shiny, with a fine usually conspicuous reticulate nervation; flowers in lower leaf-axils, often pendulous; ovules not basally attached..... 6. *Austromimusops*.
- Seeds laterally flattened with a hard and shiny testa and a basal or sub-basal circular scar; endosperm present; cotyledons flat; leaves not distinctly crowded at the ends of the branches, usually more or less coriaceous, shiny on upper surface, the nervation usually not finely reticulate; flowers in the leaf-axils or sometimes also on naked branches; ovules basally attached..... 7. *Mimusops*.
- Flowers generally 3-merous; alternipetalous staminodes various, entire or more or less divided, lobed, lacerated or fimbriate, glabrous, or absent and stamens twice as many as there are corolla-lobes (i.e., usually 12); rarely some or all stamens sterile and resembling staminodes; seed with endosperm and flat, foliaceous cotyledons:
- Stamens as many as there are corolla-lobes (i.e., usually 6), alternating with as many or nearly as many alternipetalous staminodes; in the South African species corolla-lobes always with well-developed, lateral appendages and testa hard..... 8. *Manilkara*.
- Stamens twice as many as there are corolla-lobes (i.e. usually 12); alternipetalous staminodes O, but occasionally some or all the stamens abortive and reduced to sterile staminode-like organs (in the latter case the normally present, lateral appendages to the corolla-lobes small or occasionally O); testa rather thin, crustaceous and brittle when dry..... 9. *Muriea*.

# 1. SIDEROXYLON

*L.*, Gen. Pl. ed. 5, 89 (1754); Roem. et Schult., Syst. 4: 45 (1819); Endl., Gen. 739 (1837); Harvey, Gen. S. Afr. Plants 224 (1838); A.DC., Prodr. 8: 177 (1844), pro parte; Benth. et Hook. f., Gen. Pl. 2, 2: 655 (1876), pro parte; Baker in Oliv., Fl. Trop. Afr. 3: 503 (1877), pro parte; Engler in Engler-Prantl, Natürl. Pflanzenfam. 4, 1: 143 (1890), pro parte, and Mon. Sapot. Afr. 25 (1904), pro parte; Harvey ex Wright in Dyer, Fl. Cap. 4, 1: 142 (1906); Baehni in Candollea 7: 49 (1938), pro parte; H. J. Lam in Rec. Trav. Bot. Néerl. 36: 521 (1939); Phillips, Gen. S. Afr. Fl. Plants, ed. 2, 567 (1951).

*Calvaria* Comm. sensu Dubard in Ann. Mus. Col. Marseille 20: 84 (1912); H. J. Lam in Occ. Papers Bern. P. Bishop Mus. Honolulu 14, no. 9: 138-139 (1938); Adamson in Adamson and Salter, Fl. Cape Penins. 667 (1950).

Type Species: *Sideroxylon inerme* L. (see discussion below).

Trees or shrubs. *Flowers* normally 5-merous throughout, all whorls single. *Corolla-lobes* without lateral appendages *Alternipetalous staminodes* petaloid, with a broad base. *Ovules* basally attached. *Berry* 1-seeded. *Seed* depressed-globose, usually more or less 4- or 5-angled and somewhat ribbed; scar small, circular, situated in a basal depression of the seed; testa thick and bony; endosperm copious; cotyledons thin, foliaceous; embryo in the type species horizontal.

There has been a considerable amount of disagreement as regards the delimitation of the genus. Basing the genera of Sapotaceae almost exclusively on the structure of the flowers Bentham and Hooker and Engler included many forms with the flower pattern: sepals 5, petals 5 without lateral appendages, alternipetalous staminodes 5, stamens 5, ovary 5-loculated, in one large genus *Sideroxylon* which is certainly not homogeneous. Pierre, and later Dubard [see Ann. Mus. Col. Marseille 20 (1912)], using other characters apart from the floral structure, (e.g. the seeds) came to the conclusion that only a few species had to be retained in *Sideroxylon*, excluding, for instance, all forms which do not possess a basal scar. Unfortunately, Dubard placed the type species *S. inerme* L. in the genus *Calvaria* Comm. emend. Dub., as distinct from *Sideroxylon* L. sensu Dub. (in which he includes forms with a basal scar but not with a horizontal embryo as in *Calvaria* sensu Dub.).

The generic description agrees in principle with the delimitation of the genus as understood by Baehni (op. cit.). Baehni mentions *Sideroxylon inerme* as the type species, but his description of the genus contains an error; the berry is said to be 4-seeded. This is obviously a misprint or an oversight, because he clearly agrees with Dubard's ideas although he points out that Dubard erred when he took up the name *Calvaria*. Baehni is also inclined to include Dubard's genus "*Sideroxylon*" (Dub., op. cit., p. 81): "Nous adoptons l'idée de Dubard qui consiste à restreindre le genre aux seules espèces à cicatrice basilaire, mais nous y réintégrons cependant les *Calvaria* sensu Dubard" (Baehni, op. cit., p. 492). This seems to be reasonable, because Dubard's genus *Calvaria* (= *Sideroxylon* sensu str.) and his genus *Sideroxylon* (= *Mastichodendron* Jacq.) differ only in the position of the embryo. Under this delimitation the genus includes a few species in America, probably only two in Africa and a few in Asia.

As regards the fixation of *S. inerme* as the type species, Linné mentioned two species in Sp. Pl. ed. 1, viz. *S. inerme* and *S. spinosum*. Both are properly defined and have never been confused with any other species. *S. spinosum* was placed in the monotypic genus *Argania* by Roemer and Schultes (Syst. Veg. 4: 46) as *Argania Sideroxylon* R. et S. [= *Argania spinosa* (L.) Skeels], leaving *S. inerme* L. as the only species in *Sideroxylon* and thus typifying it.

***Sideroxylon inerme* L.**, Sp. Pl. ed. 1: 192 (1753); Burm. f., Prodr. Fl. Cap. 6 (1768); Drege, Zw. Pflanzeng. Doc. 144, 153 (1843); A. DC. in DC., Prodr. 8: 182 (1844); Wood, Natal Pl. 4, 1: pl. 314 (1903) Engl., Mon. Sap. Afr. 27, t. 8 fig. B (1904), incl. var. *schlechteri* Engl.; Wright in Dyer, Fl. Cap. 4, 1: 438 (1906); Sim, For. Fl. Cape Col. 252, pl. 295 (1907); Marloth, Fl. S. Afr. 3: 36, pl. 10 (1932); Gerstner in J. S. Afr. Bot. 12: 47, fig. 1 (1946). *S. cinereum* Lamk., Encycl. 1: 244, (1789), partim; Drege, op. cit., 222. *S. diospyroides* Baker in Oliv., Fl. Trop. Afr. 3: 502 (1877); Engler, op. cit. 27, t. 27, fig. A.

*Myrsine querimbensis* Klotzsch in Peters, Reise Mossamb., Bot. 185 (1862).



*Calvaria inermis* (L.) Dubard in Ann. Mus. Col. Marseille 20: 86 (1912), incl. var. *zanzibarensis* Pierre ex Dub.; Adamson in Adams, and Salter, Fl. Cape Penins., 667 (1950). *C. diospyroides* (Baker) Dub., op cit. 87.

A shrub or small tree, up to 8 m. occasionally 10–20 m. high, but usually branched from the base and not forming a clean bole. *Innovations* reddish-brown tomentose. *Leaves* in vivo dark green and shiny above, paler below, often drying a peculiar dull greyish-green colour above, pale greyish brown beneath, occasionally (and especially the younger ones) drying dark olive-green above and reddish beneath, usually quite glabrous (except when very young), but occasionally with irregular chocolate-coloured, often powdery, patches of adpressed hairs; blade usually elliptic to obovate-oblong, more rarely (ob-)ovate, ovate-lanceolate, obovate-spathulate or (ob)lanceolate, 4–9 (–12) cm. long and 2–4 (–5) cm. wide, with subreflexed edges, obtuse (sometimes emarginate or retuse), its base acute or subacute, sometimes distinctly cuneate, always more or less decurrent on the petiole; midrib prominent beneath, secondary nerves 7–10 on either side, thin, more or less immersed and not very conspicuous; tertiary nerves not to hardly distinguishable from the fine reticulate nervations, the latter in older (dried) leaves often inconspicuous, but quite distinct in younger ones; petiole rather stout, often thickened towards the base, at first rusty-tomentose but soon quite glabrous, at least near the top distinctly winged by decurrent leaf, 6–10 (–15) mm. long. *Flowers* disagreeably scented, in few to many-flowered and sometimes very dense fascicles, occasionally (a few) flowers solitary, in the axils of the lower leaves on the branches, sometimes also on the naked branches just below the leaves, often raised on short warts. *Bracts* minute, deciduous, rufo-tomentose. *Pedicels* rather thick, slightly and gradually broadening towards the top, not very abruptly passing into the calyx, 2–12 mm. long, sparingly whitish-pubescent, in fruit hardly lengthening but becoming much stouter, 1–1½ mm. thick and often glabrescent. *Calyx* 2–2½ mm. long, the lobes about as long as the calyx-tube, broadly ovate, subacute, erect, entire, ciliate, with a paler edge when dry, finely and sparingly whitish-pubescent, in fruit adpressed, scarcely accrescent. *Corolla* greenish-white, about twice as long as the calyx-lobes, rotate, up to about 5 mm. across; tube short, lobes usually longer than the tube, ovate, entire, obtuse, glabrous. *Stamens* inserted in the throat of the corolla tube, longer than the corolla lobes. *Alternipetalous staminodes* ovate-lanceolate to oblong or oblong-lanceolate, as long as or slightly shorter than the corolla lobes, but always less wide than the latter, usually more or less distinctly incised, serrate, lacerate, dentate, crenulate or with a wavy edge, acute, acuminate or obtuse, sometimes tri- or multi-dentate at the apex. Ovary conical-semi-ovoid, covered with rather long adpressed white hairs (except in a zone near the base), usually 5-celled but occasionally 3, 4- or 6-celled; style about the same length as the ovary, glabrous. *Berry* black, globose, smooth, up to 12 mm. in diam. when fresh, when dry up to 10 mm. in diam. and wrinkled, usually crowned with the short persistent style; pulp purple or purplish-green, with white viscid juice; the latex long remaining sticky in dried specimens. *Seed* black when fresh but drying a shiny yellowish brown, usually depressed semi-globose or ellipsoid, rarely higher than broad, usually more or less distinctly 4- or 5-angled and 5-ribbed, sometimes indistinctly lobed, 6–8 mm. long. 5–7 mm. wide and 5–8½ mm. high rarely up to 9½ × 8 × 7½ mm., with several (4 or sometimes more) more or less distinct grooves which are most conspicuous near the scar, and with 2–4 small impressions between the grooves close to the scar.

CAPE PROVINCE.—Cape Peninsula: *Marloth* 584; *Chapmans' Bay*, *Wolley Dod* 3444 (BOL); *Gordon's Bay*, *Gerstner* 6144; *Witsand*, *Smuts* 1190. Caledon: *Onrust Riv.*, *Schlechter* 10396. Bredasdorp: *Bredasdorp*, *Smith* 2587. Riversdale: *Riversdale*, *Muir* 148; *Marloth* 3536. Mossel Bay: *leg. Town Clerk, Mossel Bay* (specimen of the "Post Office Tree", declared a national monument, PRE herb. no. 28382). Knysna: *Kapp* 100; *Foucade* 623 (BOL). Humansdorp: *Phillips* 3328; *Klipdrift*,



*Thode* 2490 (PRE). Uitenhage: *Alexander*; *Ecklon* or *Ecklon & Zeyher* (L); *Ecklon & Zeyher* (GRA). *Zeyher* 17 (BOL); Zwartkopsrivier, *Drege* (L). Port Elizabeth: Redhouse, *Mogg* 4672 (PRE). Alexandria: *Kariega*, *White* 101 (GRA). Bathurst: Karouga Mouth, *Britten* 2350; Kowie and Pt. Alfred, *Tyson* s.n.; *Britten* 1885; *Barker* 2106. Albany: near Riebeeck East, *Dyer* 3321. Alice: *Acocks* 8987. Fort Beaufort: *Story* 1698. Stutterheim: Fort Cunynghame, *Galpin* 2468. King Williams Town: near King Williams Town, *Comins* 1031. East London: *Smith* 3816, *Galpin* 9843. Queenstown: near Queenstown, *Galpin* 8137. Komgha: Komgha, *Flanagan* 777; Kei Mouth, *Flanagan* 770. Kentani: *Pegler* 882. Port St. Johns: *Galpin* 11465. Cape without precise locality: specimen in Linnaean herbarium (photo in PRE), lectotype!

NATAL.—Port Shepstone: Paddock, Oribi Gorge, *McClellan* 267. Umzinto: Umkomaas, *Pennington* s.n. (NH no. 27756). Pinetown: Isipingo, *Ward* 570; Amanzimtoti: *Kotze* 452 = FD Herb. 6875. Durban: near Durban, *Wood* 8707, 9578. Inanda: Tongaat Beach, *Hillary* 375 (NU). Lower Tugela: Darnall, *Schmidt* 41 (NH). Estcourt: Mooi River, *Wood* 6306. Weenen: between Weenen and Estcourt, *Edwards* 702. Msinga: near Tugela Ferry, *Edwards* 935. Mtunzini: *Lawn* 623 (NH). Eshowe: Eshowe, *Gerstner* 1945 (NH). Hlabisa: False Bay, *Gerstner* 4818; Hluhluwe Game Reserve, *Ward* 1895. Ngotshe: near Magut, *Acocks* 13023; *Codd* 1961; *West* 2117.

SWAZILAND: on road to Komatipoort, *Pole Evans* 3463, 3467; near Stegi, *Compton* 26017; *Rodin* 4548, Usutu River, *Miller* S249.

TRANSVAAL.—Nelspruit: Kruger National Park, near Pretorius Kop, *Codd* 6029; near Skukuza, *Codd* 5735. Barberton: Komatipoort, *Rogers* 20800; *Codd* 7776.

PORTUGUESE E. AFRICA.—Sul do Save, Maputo, *Hornby* 2668; *Myre & Balsinhas* 607; between Umeluzi and Porto Henrique, *Myre & Carvalho* 92; Lourenço Marques, *Schlechter* 11710 (L, GRA, PRE, BOL; type no. of *S. inerme* L. var. *Schlechteri* Engl.); *Borle* 418; *Bremekamp* LM60a; *Rodin* 4173; Porto do Oura Beach, *Gomes e Sousa* 3926; Inhaka Island, *Mogg* sm., Mrs. *Moss* s.n.; Goba Mts, *Torre* 6490; Nuanetsi-Limpopo Valley nr. Transvaal Border, *Smuts* P. 322, Guifa, *Pedro & Pedrogão* 2135; between Muianga and Macia: *Pedrogão* 1443; near Chibuto, *Pedro & Pedrogão* 1534; between Su Larrime and Ganda, *Pedro & Pedrogão* 1890. Sabi River, near Meringua, *Chase* 2535. Niassa: near Cabo Delgado, *Barbosa* 2167 (LM).

TANGANYIKA Terr.—Morogoro Distr.: Kwaba, *Wigg* 974. Kisarawe distr.: Kisiju, *Semsei* 1377, *Paulo* 153.

KENYA COL.—Greater Kiboko River: *Jarrett* 518.

Mr. B. de Winter kindly examined the Linnaean Herbarium in London and informed me that there is only one specimen which is undoubtedly *Sideroxylon inerme* and must be considered to be the lectotype (Mr. de Winter matched it with a specimen *Hutton* s.n. from Fish River Heights, Albany, C.P.). *S. inerme* was one of the first Sapotaceae known in Europe and one of the oldest plates is found in Burman, Dec. Rar. Afr. (1738), p. 238, t. 94, fig. 2. The seed is unmistakable and Burman also mentions: “. . . in Cod. Wits. . . . latescens . . . vocatur”.

This plant was described from South Africa by Linné and, in its typical form with comparatively narrow leaves and long pedicels, is found from the Cape Peninsula eastwards along the coast to Natal and extends into Portuguese East Africa. Baker

described a species *S. diospyroides*, from Zanguebar in tropical East Africa, which has smaller flowers, short pedicels and obovate-cuneate leaves. Engler remarked on the similarity between the two, but mentioned the following differences:—

- (1) pedicels of *S. diospyroides* shorter than in *S. inerme*,
- (2) staminodes broader and acuminate in *S. diospyroides*, narrower and not acuminate in *S. inerme*.
- (3) seed of *diospyroides* smaller than that of *S. inerme*.

Acuminate and broad staminodes and small seeds are, however, also found in specimens of *S. inerme* from the Cape and Mr. de Winter, who studied the material at Kew, informed me that the only difference he could find was in the length of the pedicels.

The material from Portuguese East Africa is very often intermediate and includes forms with narrow leaves, short pedicels and small fruits and forms with broad leaves (as in typical *S. diospyroides*) with large seeds, etc. These intermediate specimens link up the two forms so that in my opinion, *S. diospyroides* only represents a minor geographical variant of *S. inerme* and is not even worthy of varietal rank.

Doubtful localities are: "Near Pretoria", *McLea* in herb. Bolus no. 5698 (BOL, PRE), because this species has never since been found near Pretoria, and "Johannesburg: Melville": *Moss* 15906 (J). Dr. J. B. Gilliland, formerly of the Dept. of Botany, Witwatersrand University, has kindly informed me that there is no trace of the species anywhere in the Witwatersrand area.

#### *Excluded species:*

*Sideroxylon argenteum* Thunb., Prodr. Fl. Cap. 36 (1794) = *Rhus thunbergii* Hook. = *Heeria argentea* (Thbg.) Meissn.

*Sideroxylon randii* S. Moore = *Pouteria magalismontana* (Sond.) A. Meeuse (see p. 335).

*Sideroxylon dentatum* Burm. f., Prodr. Fl. Cap. 6 (1768) = *Curtisia dentata* (Burm. f.) C. A. Smith in J. S. Afr. Forestry Assoc. 20: 34, 50 (1951). This species was legitimately published, as Burman based it on the plate and description of his father's *Sideroxylon foliis acuminatis dentatis, fructu monospermo flavo* [Burm., Dec. Rar. Afr. Plant. (1738), p. 235, t. 82]. The plant in question is undoubtedly the same as published by Aiton [Hort. Kew ed. 1 (1789), p. 162] under the name *Curtisia faginea*. Not only are the elder Burman's plate and description quite adequate to recognise the species, but he also mentioned the name "Assagay-Boom" used by the Dutch at the Cape, under which name it is still known. Moreover, Aiton, l.c. quotes "Burm. Afr. p. 235 t. 82" and the phrase name "*Sideroxylon foliis acuminatis* etc.", and Harvey in Harv. and Sond., Fl. Cap. 2: 570, sub *Curtisea faginea* Ait., also mentioned "Burm. Dec. Afr. p. 235, t. 82". This identity had already been recognised by the late C. A. Smith, who did not give any reasons, however, when he proposed the above-mentioned change of name.

## 2. CHRYSOPHYLLUM

*L.*, Gen. Pl. ed. 5, 89 (1754); A. DC. in DC., Prodr. 8: 56 (1844): Benth. et Hook. f., Gen. Pl. 2: 653 (1876); Baker in Oliv., Fl. Trop. Afr. 3: 498 (1877), ex parte: Engler in Engler & Prantl., Nat. Pflanzenfam. ed. 1, 4, 1: 147 (1890), pro majore parte, in Nachträge 278 (1897), and Mon. Sap. afr. 38 (1904) ex parte et exclus. Section *Zeyherella*; Wright in Dyer, Fl. Cap. 4: 436 (1906), pro parte; Pilger in Engler & Prantl., Pflanzenf., Nachträge 1897–1907: 288 (1908); Hutch. & Dalz., Fl. W. Trop. Afr. 2, 1: 8 (1931); Eyma in Rec. Trav. Bot. Néerl. 33: 201 (1936), (with discussion on p. 157–158); Baehni in Candollea 7: 429 (1938); Phillips, Gen. S. Afr. Flow. Pl. ed. 2, 568 (1951) pro parte.

*Donella* Pierre ex Baill., Hist. d. Pl. 11: 294 (1892).

*Gambeya* Pierre, Not. bot. Sapot. 61 (1891); Baillon, Hist. d. Pl. 11: 296 (1892).

Type species: *C. cainito* L., Sp. Pl. ed. 1, 192 (1753).

Trees or shrubs, rarely climbing; ultimate branches and lower surface of leaves often densely adpressed-tomentose; lateral nerves of leaves parallel, close or distant, usually spreading and curved near the margin; tertiary nerves usually inconspicuous. *Stipules* wanting or at least very early deciduous. *Flowers* axillary, or on the naked branches below the leaves, solitary or in fascicles, rarely sessile, usually isomerous. *Sepals* 5 (rarely 4, 6 or 7); lobes entire, imbricate. *Corolla* 5 (4-, 6- or 7-) lobed; lobes entire, imbricate; tube cylindric, urceolate or campanulate, usually short. *Alternipetalous staminodes* 0. *Stamens* usually short, not or but little exerted; filaments inserted in the throat of the corolla tube at the base of the lobes and short, or inserted lower down and longer; anthers versatile, more or less dorsiflex, ovate to triangular, often apiculate, sometimes somewhat sagittate at the base. *Ovary* hairy, 5- or more rarely 4-, or 6-7-loculated; style columnar, short, thick, glabrous; ovules with lateral or basilateral attachment. *Berry* 1- to few-seeded, but usually 3-5-seeded. *Seeds* with long and narrow ventral scar; testa hard, smooth and shiny; endosperm copious, cotyledons thin and foliaceous.

Between 100 and 200 species described, but undoubtedly some of them have been or have to be referred to other genera, because the absence of presence of alternipetalous staminodes is *not* a reliable character in Sapotaceae if not used in conjunction with other characters and many species without or apparently without staminodes but with seeds altogether different from the type species of *Chrysophyllum* were at one time or another placed in the genus *Chrysophyllum*. Krause, Engler and later Eyma (cf. Eyma, op. cit., p. 157-158) and Baehni (op. cit., p. 405-406) criticised the systems of classification of Sapotaceae in which the character of the alternipetalous staminodes is over-emphasized, so that, e.g., a separate tribe "Chrysophyllinées" based on the absence of staminodes was recognised by Dubard. Eyma (l.c.) and Lam [in Rec. Trav. Bot. Néerl. 36 (1939), p. 509-525] pointed out the relationships with the Sideroxyleae and indeed *Chrysophyllum* is, in my opinion, to be included in this group. The genus *Chrysophyllum* - *sensu lato* - was split up (at least in Ms.) into a large number of smaller genera by Pierre (*Pachystela*, *Donella*, *Gambeya*, *Zeyherella*, *Malacantha*, etc.). Some of these genera were adopted by Engler (1904, l.c.) such as *Pachystela* and *Malacantha*. The remainder, at least as far as the African representatives are concerned, and if Engler's section *Zeyherella* is excluded, is a fairly homogenous group which is distinct from *Sideroxylon* s.l. and *Pouteria* s.l. in that the staminodes are completely lacking and the seed characters are different.

*General Distribution*: Mainly tropical America, less than 30 species in Africa, one in Madagascar; the few species recorded from tropical Asia, Australia and the Pacific have mostly been referred to other genera (e.g. *Nesoluma*).

The African representatives belong to two sharply defined subgenera:

(1) *Chrysophyllum* L. subgenus *Donella* (Pierre ex Baill.) A. Meeuse, stat. nov. *Donella* Pierre ex Baill., Hist. d. Pl. 11: 294 (1891), pro gen. *Chrysophyllum* L. sect. *Donella* (Pierre ex Baill.) Engl., Mon. Sapot. Afr. 41 (1904).

*Leaves* with numerous close, parallel lateral veins, usually dark green above and as a rule quite glabrous; *corolla* with a short broad unceolate to subglobose tube.

Type species: *Chrysophyllum roxburghii* Don = *C. lanceolatum* (Bl.) DC. (India to New Guinea).

(2) *Chrysophyllum* L. subgenus *Gambeya* (Pierre) A. Meeuse, stat. nov. *Gambeya* Pierre, Not. Bot. Sapot. 61 (1891) (pro gen.). *Chrysophyllum* L. sect. *Afrochrysophyllum* Engl. in Engl. & Prantl., Nat. Pflanzenfam., Nachträge 272 (1897). *Chrysophyllum* sect. *Gambeya* (Pierre) Engl., Mon. Sapot. Afr. (1904).



*Leaves* with rather distant and usually on lower surface more or less prominent lateral veins and as a rule more or less rufo-tomentose on lower surface; *corolla* with a subcylindric to campanulate tube.

Type species: *Chrysophyllum subnudum* Baker (West Tropical Africa).

A few species of *Chrysophyllum* occur in Southern Africa, of which only two are treated here (one South African, the other occurring in Southern Rhodesia and Portuguese East Africa fairly close to the Union border):

- Leaves almost completely glabrous and green when old, with fine parallel nervation, up to 11 cm., but usually under 8 cm. long..... 1. *C. viridifolium*.  
 Leaves rusty-tomentose or sometimes greyish tomentose beneath, often 10-20 cm. long; lateral nerves distant, very prominent beneath..... 2. *C. gorungosanum*.

1. *C. viridifolium* Wood et Franks in Wood, Natal Pl. 6: 569 (1912); Gerstner in J. S. Afr. Bot. 12: 48, Fig. 3 (1946) Type: *Franks* in herb. Wood No. 11636 from Stella Bush, Berea, near Durban, in NH, holo! photo in PRE!, in BOL and PRE, isos!).

A large tree, 10-30 m. high, with a girth at 2 m. from the ground of 150 cm. and over. *Trunk* usually unbranched for 5 m. or more, and strongly many-ribbed to the origin of the branches. *Bark* grey. *Innovations, petioles, pedicels, and calyx-lobes* finely rusty velvety-tomentose, the older twigs and fruiting pedicel glabrous. *Leaves* scattered on the branches, thinly coriaceous, exstipulate, 4-8 (-11) cm. long and 2-3.5 (-4.5) cm. wide (those of coppice shoots are the longest), oblong or (ob-) ovate-oblong, more rarely ovate or elliptic, obtuse or bluntly acuminate with oblong, obtuse about 8 mm. long and about 3 mm. wide acumen, more or less rounded but always decurrent at the base, dark glossy green above, lighter and dull beneath, glabrous when mature, except near the midrib and at the very base near the petiole beneath, with reflexed edge; midrib channelled above, prominent beneath and, at least when dry, discolourous, reddish or brownish; lateral nerves numerous (about 11 per cm.), patent but not quite horizontal, often forked, almost straight, parallel (hence the leaf appearing striate), joining the fine intramarginal vein close to the margin. *Petioles* 5-10 (-12) mm. long more or less dorso-laterally flattened, channelled above. *Flowers* 2-2.5 mm. long, nearly globose, in clusters in the axils of the lower leaves and on raised warts on the older twigs; clusters few- to many-flowered (sometimes with over 20 flowers); bracts very minute or wanting; pedicels thin, almost capillary, 4-5 mm. long. *Calyx-lobes* free nearly to the base, erect, concave, ciliate. *Corolla* scarcely longer than the calyx; tube urceolate; lobes erect, ovate-oblong-rotundate, very obtuse or rounded, ciliate (at least at the lateral margins). *Stamens* inserted half way down the corolla-tube or even lower; filaments terete, longer than the apiculate anthers. *Ovary* depressed-globose, 5-celled, densely rusty-villous, often somewhat lobed; style conical-cylindric from a broad base, thick, obtuse or truncate, longer than the ovary. *Berry* depressed-globose with a depression near the top (shaped like a small apple), often ribbed (at least when dried), 20-30 mm. long and 20-35 mm. in diam., smooth, glabrous, yellow when ripe with yellowish-white pulp saturated with white latex, 3-5-seeded; *pedicel* under fruit much incrassate, 5-8 mm. long and 1.5-3 mm. thick, rugose; calyx usually not persistent in fruit. *Seeds* semi-circular-elliptic, compressed, 15-18 mm. long, 9-12 mm. wide and 5-6 mm. thick in centre, keeled and curved at the back, almost straight at the ventral side with a long narrow, linear scar occupying nearly the whole length of the seed; testa hard, shiny as if polished, bright yellowish-brown when dry.

NATAL.—Durban: Berea, *Franks* in herb. Wood No. 11636 (NH, holo! PRE, BOL, isos!); Durban: Bayer 14485. Eshowe: *Gerstner* 2071 (NH), 2546 (NH, PRE, BOL), *Lawn* 202 (NH); *Kotze* 34 = F.D. herb. No. 3178 (SAFD). Ingwavuma: Bayer s.n. (NH. No. 31432). Ngoya Forest: *Mehliss* FD No. 2686 (SAFD).



SWAZILAND: *N.N.* in Forestry Herb. No. 5328 (PRE); Hlatikulu, *Boocock* 31 = FD herb. No. 2686 (SAFD).

PORTUGUESE E. AFRICA.—Sul do Save; *Gomes e Sousa* 1648 (COI, PRE).

*C. viridifolium* belongs to the subgenus *Donella* and is closely related to a number of African species of this section. From *C. pruniforme* Engl. (Mon. Sapot. Afr. p. 42, Fig. A) it differs in the shape of the fruit and the shorter seeds. *C. welwitschii* Engl. (op. cit., 41, t. 13, Fig. A) is a climbing shrub (Angola, West Tropical Africa) and differs also in the shape of the fruit and the nervation of the leaves (in COI represented by: *Welwitsch* 4830, 4831, *Gossweiler* s.n. from Lunda, Saurimo and *Gossweiler* 1644, 4439, 4852, 5011, 6908, 8048).

*C. bangweolense* R. E. Fries in Schwed. Rhodesia—Kongo exp. 1: 254 (1914) (not seen) is, judging by the description, very closely related to *C. viridifolium* if not conspecific and occurs in Rhodesia. *C. pentagonocarpum* Engl. et Krause in Engl. Bot. Jahrb. 49: 387, Fig. 2 (1913) differs in the size of the fruits and seeds (E. Africa).

2. *Chrysophyllum gorungosanum* Engl., Mon. Sapot. Afr. 8: 44; (1904) Brenan in Mem. New York Bot. Gard. 8 (5): 498 (1954). Type: *R. de Carvalho* s.n. from Gorungosa in COI, lecto!, B, destroyed. *C. fulvum* S. Moore in J. Linn. Soc. Bot. 40: 13 (1911–1912); Type: *Swynnerton* 19 from Chirinda forest, Southern Rhodesia, in BM, not seen, duplicate in SRGH!

A large tree, up to at least 50 m. high, with characteristic fluted bole. *Buds* and *young branches* rufo-tomentose, young leaves silvery-strigose above and silvery-tomentose beneath. *Branchlets* terete, glabrescent, densely leafy. *Leaves* on flowering branches 6–15 cm. more rarely up to 20 cm. long and 2·5–3·5, rarely up to 6 cm. wide, on a 7–16 mm. long petiole; those on sterile branches larger, up to 30 cm. long and 9 cm. wide on a 12–28 mm. long petiole; blade lanceolate-oblong to oblong-oblancoate or (ob) lanceolate, cuspidate-acuminate (the acumen itself obtuse or subacute), narrowed and acute or sometimes cuneate at base, coriaceous, very soon glabrous and green above, densely rusty-tomentose beneath (or more greyish-tomentose when old); midrib impressed above, very prominent below; secondary nerves 12–17 on either side, impressed above, very prominent below, 5–7 mm., more rarely up to 14 mm., apart, parallel, patent, ascending and becoming inconspicuous well within the margin; tertiary nerves hidden by the tomentum beneath but usually distinct above,  $\pm$  perpendicular to the main nerve and usually  $\pm$  parallel, connecting the secondary nerves at an angle between  $60^\circ$  and  $90^\circ$ ; ultimate nervation fine, areolate. *Petioles* terete, narrowly sulcate above, finely ferrugineo-pubescent or tomentose, 7–20 (–28) mm. long. *Stipules* O. *Flowers* in the leaf axils or on the naked branches below the leaves in, sometimes very dense, clusters, or a few of them solitary. *Bracts* O. *Pedicels* 1–3 mm. long, rather thick, shiny rusty-tomentose; some flowers almost sessile. *Sepals* almost completely free, broadly ovate, obtuse or very obtuse sometimes one of the outer ones subacute, very concave, more or less unequal,  $\pm$  3·5 mm. long; the inner ones pale yellowish-brown strigose outside and thinner in texture than the coriaceous rusty-tomentose outer ones; all sepals densely pale fulvo-strigose inside, the inner ones ciliate on one side or all round. *Corolla* white,  $\pm$  4 mm. long, the tube cylindric-inflated, slightly longer or about as long as the lobes and  $\pm$  3 mm. in diam., the lobes more or less erect and concave, obovate, ovate or subrotundate, obtuse or very obtuse, sometimes with nearly straight truncate apical edge, about  $1\cdot5 \times 1\cdot5$  mm., densely ciliate-barbellate. *Stamens* inserted in the lower half of the corolla tube; filaments about 1·5 mm. long; anthers subsagittate, shortly apiculate, about 1 mm. long. *Ovary* globose, densely hirsute, about 2 mm. in diam., slightly longer than the glabrous, cylindric, truncate style; ovules with baso-lateral attachment. *Berry* globose, sometimes somewhat apiculate, finely pubescent, up to about 3·5 cm. in diam., 4–5 seeded. *Seeds*

19–21 mm. long, 11–12 mm. wide and 5–6 mm. thick in the middle, brown, ovate-oblong, slightly attenuate and subacute at the base; the scar 12–14 mm. long and 1–2 mm. wide at the widest place.

PORTUGUESE E. AFRICA.—Gorongosa: *Rodrigues de Carvalho* s.n. (COI, lecto)!.

SOUTHERN RHODESIA.—Chipinga: Silinda, Chirida forest, Swynnerton 19 (SRGH: duplicate of type of *C. fulvum* S. Moore); *Obermeyer* 2161 (PRE, BOL); *Hack* 151/50, *Whellan* 163, *McGregor* 17/48, *Wild* 2096, 2245, *Chase* 620 (all in SRGH); *Vári* 1826, 1865 (PRE), *Jack* s.n. (SRGH, herb. No. 6355); *Chase* 427 and s.n. (SRGH, herb., No. 19262 and 19263); *Fisher* 1223 (PRE); photo of fluted bole of specimen by *N. C. Chase* in SRGH. “Eastern Border”: *Chorley* s.n. (SRGH No. 6686). *Melsetter*: *Eyles* 5721 (SRGH), *Jack* s.n. (SRGH No. 5962). Umtali: *Eyles* 5533 (SRGH).

NYASALAND.—Kota-kota Distr.: Nchisi Mountain, *Brass* 17067 (SRGH).

KENYA.—S. of Mt. Kenya; *Hockliffe* 1370 (PRE).

The type gathering of *Chrysophyllum gorungosanum* Engl. is sterile. As the material in Berlin was destroyed and Engler (l.c.) cited both “Herb. Coimbra” and “Herb. Berlin”, the material in COI is taken as the lectotype. The type material consists of coppice shoots which are a perfect match of coppice shoots of specimens from the type locality of *Chrysophyllum fulvum* S. Moore from Rhodesia (such as *Obermeyer* 2161). In addition, the only true *Chrysophyllum* of the section *Gambeya* found in the area near the type locality is *C. fulvum* S. Moore (Gorongosa is the region bordering Chipinga and Melsetter in S. Rhodesia), so that there is very little doubt that these two names are synonyms.

#### Excluded species:

*Chrysophyllum magalismontanum* Sond. = *Pouteria magalismontana* (Sond.) A. Meeuse, see p. 335.

*Chrysophyllum natalense* Sond. = *Pouteria natalensis* (Sond.) A. Meeuse, see p. 339.

*Chrysophyllum wilmsii* Engl. = *Pouteria magalismontana*.

#### EXPLANATION OF FIGURES.

FIG. 1.—*Sideroxylon inermis*, seed and fruit (the seed seen from the side, the top and the base): (a) From a specimen *Kotze* 452 (from Amanzimtoti, Natal), (b) From a specimen *Galpin* 2468 (from Stutterheim, E. Cape). (All figures if not otherwise stated, natural size).

FIG. 2.—*Chrysophyllum viridifolium*, seed and fruit (from *Gerstner* 2546 Eshowe, Zululand). In this figure, and in all subsequent figures of seeds, the seed is shown from the lateral side and from the ventral side.

FIG. 3.—*Chrysophyllum gorungosanum*, seed and fruit (from *Obermeyer* 2161, Chipinga, S. Rh., in PRE).

FIG. 4.—*Pouteria magalismontana*, seed and fruit (from *Gerstner* 5728, Louis Trichardt, N. Transvaal). (In the lateral view a part of the testa has been removed).

FIG. 6.—*Pouteria natalensis*, seed and fruit (from *Lawn* 57, Eshowe, Zululand).



1a



1b



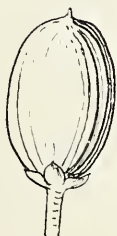
2



3



4



6



## 3. POUTERIA

Aubl., Hist. Pl. Guiane Fr. 1: 85 (1775); Eyma in Rec. Trav. Bot. Néerl. 33: 159 (1936); Baehni in Candollea 9: 149, pro parte; Herrmann-Erlee & Royen in Blumea 8: 453 (1957).

*Lucuma* Molina, Saggia Chil. 186 (1782).

*Sersalisia* R. Br. Prodr. 529 (1810), p.p., as to type species.

*Zeyherella* Pierre ex Baill., Hist. d. Pl. 11: nota 3 (1892), nomen nudum.

*Pachystela* Pierre ex Engl., Mon. Sapot. Afr. 35 (1904).

*Chrysophyllum* L. sect. *Zeyherella* (Pierre ex) Engl. op. cit., 47.

*Breviea* Aubr. et Pellegr. in Bull. Soc. Bot. France 81: 792 (1934).

*Aningeria* Aubr. et Pellegr., op. cit., 795.

*Chrysophyllum* Auct. et *Sideroxylon* Auct., ex parte.

Type species: *P. guyanensis* Aubl. (South America).

Trees or shrubs. *Branches* terete, the young ones often tomentose. *Leaves* varying from paperyaceous to coriaceous, exstipulate or occasionally stipulate, often crowded towards the tips of the branches; often hairy on both sides or the lower side, usually more or less glabrescent but rarely ultimately or initially quite glabrous; secondary nerves as a rule distinctly stronger than tertiary ones; tertiary nervation mutually parallel or reticulate, parallel with or more or less perpendicular to secondary nerves; petioles usually distinct; stipules, if present, subulate or setaceous. *Flowers* fasciculate in axils of leaves or leaf-scars, sometimes inserted on brachyblasts (raised warts, etc.), rarely solitary, pedicelled or sometimes sessile; 2-4 bracteoles sometimes present. *Sepals* generally 5, occasionally 4 or 6 in a single whorl, connate at the base only, subequal or more or less unequal (innermost narrower), deciduous or persistent in fruit. *Corolla* exserted, sometimes only a little so, tubular to campanulate; lobes 5 (occasionally 4 or 6-8), more or less erect to somewhat spreading but never reflexed; the tube short but distinct to occasionally rather long. *Alternipetalous staminodes* generally 5, but sometimes fewer, or absent, occasionally 6-8, generally lanceolate or subulate, but sometimes squamiform or larger and petaloid. *Stamens* 5 (occasionally 4 or 6-8), inserted in or near the throat of the corolla. *Ovary* generally 5-loculated, sometimes with a subcupular disc, more or less conical, gradually contracted into the, usually short, cylindric or subulate style. *Fruits* 1-5-seeded but often only 1 or 2 seeds develop in many species; pericarp various but rarely hard. *Seeds* with a thin or sometimes rather thick, often brittle, crustaceous testa and a large to very large cicatrix covering the ventral half of the seed or more, sometimes cicatrix smaller, linear or oblong; cotyledons thick and fleshy; endosperm absent or present as a thin membranous layer.

The delimitation of this genus, as given here, agrees with the circumscription of Herrmann-Erlee and Van Royen (l.c.), except in one character: I include some species with more or less persistent stipules, whereas the Leiden authorities state: "Leaves . . . exstipulate". As the leaves of Sapotaceae are in principle all stipulate, but apparently often exstipulate because the stipules are so early deciduous, I cannot accept the presence or absence of stipules in this family as a very important generic character.

This delimitation agrees also very well with Eyma's conception of the genus based on a study of South American species. As circumscribed here there are about 150 species, in tropical and subtropical America, Africa, Asia, Australasia and the South-West Pacific region.

The genus, as defined here, is considerably smaller than Baehni's enormous genus *Pouteria* of 300-500 species, which includes forms with and without endosperm and with an enormous variation in the characters of the corolla, the stamens, etc. Mr. J. P. H. Brenan of Kew criticized Baehni's very broad generic limits of *Pouteria* in



Mem. New York Bot. Gardens 8 (5): 499 (1954) as follows: "In rejecting Baehni's wholesale amalgamation of African sapotaceous genera under *Pouteria* Aubl., I recognise that the delimitation of genera in this family is often fiendishly difficult and very much a matter of opinion. But at the same time I remain unconvinced that the proposed fusion is going to clear the air and make identification easier". This statement expresses aptly the opinion of other modern authors. Van Royen has especially criticized the "amalgamation" of species without endosperm (which he retains in *Pouteria* if not referred to different genera for other reasons) and those with copious endosperm (referred to *Xantholis* Rafin. and *Planchonella* Pierre), see *Blumea* 8: 238-239. Dr. Van Royen kindly pointed out to me that at least some of the African species included by Baehni in his large genus *Pouteria* are indeed *Pouteria* sensu Van Royen, but apparently *Planchonella* does not occur in Africa. My studies, limited as they are, confirm this conclusion. <sup>(1)</sup>

As far as the African sapotaceous genera are concerned, the species to be included in *Pouteria* sensu mihi are sharply distinguished from the genus *Chrysophyllum* sensu mihi in that they have usually alternipetalous staminodes and seeds with a thin testa, a broad ventral scar and no endosperm, whereas the other genus lacks alternipetalous staminodes and has seeds with a hard thick testa, a narrow ventral scar and copious endosperm. This implies that several species at one time under *Chrysophyllum* have to be transferred to *Pouteria*.

On the other hand, there are some African genera included in *Pouteria* by Baehni which, although they have the same type of fruit and seed, (i.e. thin testa, large scar, no endosperm) to my mind, do not belong here because they differ in other respects. *Vincentella* Pierre with its totally reflected corolla-lobes, very short corolla-tube, long and capillary stamens, is clearly distinct and is retained. Mr. Brennan independently came to the same conclusion. The genus *Synsepalum* A. DC. of tropical West Africa may also have to be retained on account of the strongly gamosepalous calyx.

It is difficult to say how many species of *Pouteria* sensu mihi there are in Africa, because I have studied only a few representatives and there are probably more. A count of Baehni's species (African) under *Pouteria*, omitting those belonging to *Vincentella* and *Synsepalum*, and including some which Baehni refers to *Chrysophyllum* but are better placed in *Pouteria*, shows a total of about 20 African species probably to be retained in *Pouteria*.

Leaves with secondary veins 1-3 cm. apart and very prominent on lower surface. . . . 1. *P. brevipes*.  
Leaves with secondary veins much closer (several per cm.) and not very prominent:

- Leaves usually rounded or emarginate at the apex, usually rusty-tomentose rarely more silvery, on lower surface; flowers fasciculate or solitary, often on raised warts on the naked branches below the leaves; pedicels and calyx rusty-pubescent . . . . . 2. *P. magalismontana*.  
Leaves usually bluntly acuminate at the apex, usually silvery-white on lower surface; flowers solitary or 2-3 together sessile in the leaf-axils, calyx with a dark tobacco-brown pubescence. . . . . 3. *P. natalensis*.

1. *P. brevipes* (Baker) Baehni in Candollea 9: 290 (1942); (for full synonymy see Baehni). *Sideroxylon brevipes* Baker in Oliv., Fl. Trop. Afr. 3: 502 (1877), type: Kirk s.n. in K, from Zanguebar.

<sup>(1)</sup> Note added in proof: Aubréville and Pellegrin in Bull. Soc. Bot. France 105: 37 (1958) raised Engler's section *Zeyherella* to generic rank (including only *Chrysophyllum magalismontanum* Sond.) and described a genus *Boivinella* with 5 species including *Chrysophyllum argyrophyllum* Hiern, *C. wilmsii* Engl. and *C. natalense* Sond. The first two I consider to be taxonomical synonyms of *C. magalismontanum* (= *Pouteria magalismontana*, see p. 335), which these authors place in a different genus (*Zeyherella*). This is an example of the other extreme, viz., excessive splitting of genera, resulting in the creation of a number of (to my mind, unnecessary) synonyms and adding to the confusion instead of clearing up the generic delimitations in the African Sapotaceae.

*Pachystela brevipes* (Baker) Baill. in Bull. Soc. Linn. Paris 11: 947 (1891), *nomen nudum*. *P. brevipes* (Baker) Engl., Mon. Sapot. Afr. 37 (1904). *P. cinerea* (Engl.) Pierre ex Engl., op cit., 36, t. 12, incl. vars.; type: *Welwitsch* 4824 in B†, isotype BM, type number COI!

*Bakeriella brevipes* (Baker) Dubard and *B. cinerea* (Engl.) Dub. in Ann. Mus. Col. Marseille 20: 27 (1912).

A tree reaching a height of at least 10–15 m. *Branches* rather thick, at first thinly pubescent or thinly brownish-tomentose, glabrescent, later longitudinally fissured and often turning ashy-gray or almost white. *Stipules* coriaceous, linear-subulate, 5–15 mm. long, brown rusty-pubescent or glabrous, very acute. *Petioles* stoutish, 5–10 (–15) mm. long, 2–4 mm. thick, flat above, when dry longitudinally sulcate. *Leaves* lanceolate-oblong or oblong-oblanccolate to obovate-oblong, 5–20 cm. long and 2–8 cm. wide, coriaceous, shiny and glabrous above, much paler and dull, shortly whitish-tomentose or glabrous below, with obtuse or shortly and bluntly acuminate apex and narrow, cuneate or decurrent-attenuate base, and revolute edge; midrib impressed and distinctly keeled above, prominent and when dry longitudinally fissured below; lateral veins 8–10 on either side, distant (1–3 cm. apart), arcuate-ascending, impressed above, very prominent below, all reaching the edge of the leaf or nearly so; ultimate nervation coarsely reticulate mainly more or less perpendicular to the midrib; veinlets very delicate and inconspicuous. *Pedicels* short and thick,  $\pm$  3 mm. long and 1–2 mm. in diam., covered with a pale fawn tomentum. *Flowers* clustered in the axils of the lowermost leaves or on the naked wood below the leaves on raised warts, sweet-scented. *Sepals* ovate-oblong, oblong or oblong-lanceolate (the inner ones narrower), 3·5–4·5 mm. long and 1·5–3 mm. wide, subacute or obtuse, more or less concave, pale fawny-tomentose outside and inside. *Corolla* glabrous; the tube  $\pm$  2 mm. long and 1–1·5 mm. in diam.; the lobes oblong or ovate-oblong, subacute or obtuse  $\pm$  4 mm. long and 1·5–2·25 mm. wide. *Atteripetalous staminodes* glabrous, lanceolate-linear, linear-subulate, or filiform, acute, acuminate and often lacerate or incised-dentate (the filiform ones not infrequently with a terminal thickening or even a small sterile anther), usually shorter than the filaments, but occasionally equalling the stamens, sometimes small, squamiform or O. *Filaments* linear-filiform, 3–4 mm. long; anthers pink (Mrs. Faulkner), 2–2·5 mm. long. *Ovary* ovoid,  $\pm$  2 mm. long and 1·5 mm. in diam., distinctly 5-lobed-sulcate below, densely fulvo-villous, situated on a flat disc; style thick, columnar, angular, widened, subcapitate-truncate and indistinctly 5-lobed at the apex, 4–5 mm. long, covered with long hairs at the base or sometimes half way up. *Fruiting pedicels* hardly changing but more or less glabrescent; the calyx persistent,  $\pm$  spreading but not reflexed. *Fruit* edible, yellow when ripe, ellipsoid, 15–22 mm. long and 9–12 mm. in diam. *Seed* the same shape as the fruit but smaller, 12–16 mm. long and 6–9 mm. in diam., scar occupying more than half the surface of the seed; testa smooth and shiny light brown, the scar duller and paler, somewhat rough.



FIG. 5.—*Pouteria brevipes*, seed and fruit (from Zenker 4324, Cameroons, in PRE).

Widespread in tropical Africa, but not recorded from Northern Rhodesia. I have seen numerous specimens from tropical East and West Africa in several herbaria and only cite those occurring in Southern Africa:

PORTUGUESE EAST AFRICA.—Manica e Sofala; Chipinga, Busi Drift (East of Melsetter, S. Rhodesia), *Whellan* 133 (SRGH). Maribane, *Gomes Pedro* 4193 (LMJ, PRE); “Na floresta de Maronga”. *Simão* 375 (LM); Matarara do Lucite, *Gomes Pedro* 4278 (LMJ, PRE). Zambezia: Quelimane Distr., Metola, *Barbosa & Carvalho* 4002 (LM, PRE). between Mualama and Gilé, *Barbosa & Carvalho* 4342 (PRE); Mocuba, *Faulkner* “Kew 18” (PRE, SRGH, COI). Niassa: Nampula, Nova Chaves, *Barbosa & Lemos* 1780 (LM); Pto. Amelia, Mueda, *Barbosa* 2238A (LM, PRE); between Mueda and Chomba *Barbosa* 2248 (LM).

SOUTHERN RHODESIA.—Vumba: Wychwood, *Ball* 14 (SRGH, PRE). Melsetter: between Hayfield and Lusitu river/Haroni, *Drummond* 5001 (SRGH, PRE).

ANGOLA.—Cuanza: Golungo Alto, between Cambondo and Luinha River, *Welwitsch* 4818 (COI); Pungo Andongo: *Welwitsch* 4824 (COI; type number of *Pachystela cinerea*); Calemba Island in Cuanza Riv., *Welwitsch* 4826 (COI); Ponta Filomene de Camera, nr. Cuanza Riv., *Gossweiler* 10649 (COI).

As regards the author of the combination “*Pachystela brevipes*”, the genus *Pachystela* was only validly described in 1904, so that Baillon’s name “*Pachystela brevipes* (Baker) Baillon”, published in 1891, is a nomen nudum and “*Pachystela brevipes* (Baker) Engl.” is the correct citation under the Rules.

## 2. *P. magalismontana* (Sond.) A. Meeuse, comb. nov.

*Chrysophyllum magalismontanum* Sond. in *Linnaea* 23: 72 (1850) (sphalm. “*magalismontana*”); Engl., *Mon. Sapot. Afr.* 47 t. 16, f. C (1904); Wright in *Dyer, Fl. Cap.* 4. 1: 437 (1906); Phillips in *Flow. Pl. S. Afr.* 3, t. 98 (1923); Marloth, *Fl. S. Afr.* 3: 36, t. 10 (1932); Gerstner in *J. S. Afr. Bot.* 12: 40, Fig. 4 (1946), and 14: 171, Figs. A–F (1948); Brenan in *Mem. New York Bot. Card.* 8 (5): 498 (1954); type: *Zeyher* 1849 from Magaliesberg, Transvaal in herb. Sonder nunc S, holo, BOL and SAM, isos!). *C. argyrophyllum* Hiern, *Catal. Afr. Pl. Welw.* 3: 641 (1898); Engl. op. cit., 46, t. 16, Fig. A; Brenan & Greenway, *T.T. Check List* 2: (1949); type: *Welwitsch* 4827, 4828, 4829, syns. in BM, 4828 in COI!) *C. antunesii* Engl. in *Engl. Bot. Jb.* 32: 137 (1903); type: *Antunes* 98 (B †, COI, lecto!). *C. carvalhoi* Eng., op. cit. (1904), 47; type: *Rodrigues de Carvalho* s.n. in COI, lecto!, B †. *C. wilmsii* Engl., op. cit. (1904), 46, t. 16, Fig. B; Wright, op. cit., 437; type: *Wilms* 1812 in B †, holo, K, iso, *C. gossweileri* De Wild., *Pl. Bequart.* 4: 130 (1926); type: *Gossweiler* 2808 in BR, dupl. in COI!

*Sideroxylon raudii* Sp. Moore in *J. Bot.* 41: 402 (1903); Wright, op. cit. 439; type: *Rand* 1017 from Johannesburg, BM, holo.; photo in J!

*Pachystela magalismontana* (Sond.) H. Lec. in *Bull. Mus. Hist. Nat. Paris* 25: 192 (1919). *P. argyrophylla* (Hiern) H. Lec., l.c.

A large tree when growing in forests (up to at least 15 m. high), but in its more characteristic form, growing on stony koppies and rocky ledges in the Transvaal, a shrub, already flowering and fruiting freely when only about 1 m. high. *Leaf-bearing branches*, especially in the shrubby form, often stout, 5–10 mm. thick, with short internodes. *Innovations and twigs* rufo-tomentose. *Leaves* often near apex of otherwise leafless branches, stipulate and sometimes thinly papyraceous when young, coriaceous when mature, first with a white bloom but soon glabrous and green above, rufo- or aureo-tomentose (older ones often more greyish- or silvery-tomentose, sometimes with a pale pink or mauve tinge) below, 4–15 cm., sometimes up to 30 cm. long, 2–5 cm., sometimes up to 7 cm., wide, those of the characteristic shrubby form usually deflexed, rather small (up to 12 cm. long and 5 cm. wide), oblong-obovate, obovate-elliptic or oblong, usually



rounded or slightly narrowed at the base, rarely obovate with cuneate base; emarginate, retuse or at least obtuse at the apex, sometimes mucronate with short, often blackish, mucro, sometimes more strongly tapering at the base and oblanceolate-oblong; petiole 6–12 mm. long; those of the forest form usually distinctly cuneate at the base, lanceolate, oblong or oblanceolate-oblong to oblanceolate-cuneate, occasionally (on coppice shoots) up to nearly 30 cm. long and 7 cm. wide on a longer (up to 24 mm. long) petiole, but usually smaller, with obtuse, rounded, emarginate or retuse, sometimes shortly and bluntly acuminate, occasionally mucronate apex; midrib immersed and narrow canaliculate above, very prominent below; secondary nerves numerous (6–7 per cm.), slender, usually inconspicuous above, partly hidden under the tomentum, but on the older leaves often losing their pubescence and becoming slightly prominent beneath, patent, straight, but distinctly ascending and curved towards the margin, sometimes joining and forming an irregularly sinuous, often very inconspicuous intramarginal vein, more rarely bifurcate and archingly joining; tertiary nerves parallel to and thinner than secondary ones, somewhat sinuous, mostly not reaching the margin without branching or joining other veins, often inconspicuous; ultimate reticulate nervation usually sparse, inconspicuous, mainly present towards the margin and  $\pm$  parallel to secondary and tertiary nerves. *Petioles* thick, subterete but often longitudinally ribbed or angled, at least when dry, rusty- or aureo-pubescent, later sometimes ashy-grey-pubescent on a brown background. *Stipules* long-subulate, often curved, pubescent, soon deciduous. *Flowers* in few- to many-flowered, sometimes very dense, fascicles, the majority usually on the lower leaflets parts of the branches or on older wood on sometimes rather large, raised warts, and fewer, or none, in the leaf axils. *Bracts* O or very minute. *Pedicels* densely rufo-tomentose, varying in length from  $\pm$  2 mm. to  $\pm$  5 mm., more rarely up to  $\pm$  10 mm. long, rather stout and gradually or more abruptly widening at the top into the calyx; rarely flowers sessile. *Calyx* 2.5–4 (–5) mm. long, rufo-tomentose outside; sepals free nearly to the base, often unequal, ovate, obtuse or subacute, often greyish-pubescent inside, 2–4.5 mm. long and 2–3.5 mm. wide. *Corolla* white or whitish, turning brown (according to the labels also “pink” or “red” in Rhodesia and East Africa, but this may refer to already wilted flowers), glabrous, varying in length from scarcely longer than to about 2 mm. longer than the calyx; tube cylindric-urceolate, usually 1–1.5 mm. sometimes up to 2 mm., rarely only about 0.5 mm. long; the lobes somewhat to distinctly spreading, broadly ovate, obtuse or subacute, 2–4.5 mm. long and about 2 mm. wide. *Alternipetalous staminodes* O or sometimes 1–5, inserted just below the sinuses between the corolla-lobes, much smaller than the latter, scale-like and minute or sometimes petaloid, ovate or suborbicular, more or less irregularly serrate, dentate or incised in the upper half, up to 1.5 mm. long and 0.5–1 mm. wide. *Stamens* subincluded, inserted at the base of the corolla-lobes; filaments 1.5–2 mm. long; anthers 1–2 mm. long, somewhat cordate-sagittate at the base before dehiscence, acute, apiculate; sometimes stamens sterile, staminodial, either resembling a stamen with a filament-like basal portion and a sagittate-cordate, broader top which often shows two longitudinal marks (cf. Gerstner, 1948, Figs. A–F), or more irregularly shaped, very rarely (fide Engler, op. cit., 47, t. 16, Fig C, and c) lanceolate, petaloid. *Ovary* globose-ovoid, about 2 mm. in diam., densely villous, 5-, sometimes 3- or 4-celled, gradually passing into the  $\pm$  1.5 mm. long, glabrous style. *Fruit* ellipsoid,  $\pm$  25 mm. long  $\pm$  18 mm. wide, dark red when ripe, edible, crowned with the persistent style, 1- or sometimes 2-seeded. *Seeds* of 1-seeded fruits compressed -ovoid, 16–20 mm. long, 14–16 mm. broad and 8–11 mm. thick; those of 2-seeded fruits with one flattened lateral side; testa light brown, shiny, thin and brittle when dry; scar linear-triangular, ventral, occupying about  $\frac{3}{4}$  of the length of the seed; 2 mm. wide or more in widest place.

*General Distribution.*—Tropical Africa, from the Congo to Tanganyika and southwards to Angola, Bechuanaland, the Transvaal, Swaziland and Natal. At least in the Transvaal this species is apparently confined to quartzite and granite rocks, so that the



plant is as much an indication of the formations as the formations are an indication of the occurrence of *P. magalismontana*. In N. Zululand, for instance, where quartzitic rocks occur locally, *P. magalismontana* is only found in the area where the rocks come to the surface.

*Selected citations;*

BECHUANALAND.—Kanye: *Hillary & Robertson* 613; Lobatsi Govt. Farm: *Miller* B/246.

TRANSVAAL.—Zoutpansberg: *Louis Trichardt*, *Hanglip*, *Gerstner* 5728. Sebasa: near Sebasa, *Codd & Dyer* 4515. Pietersburg: *Woodbush*, *Hoffmann* 22. Warmbaths: Warmbaths. *Leendertz* s.n., *Burt Davy* 2616, *Hutchinson* 1883. Brits: *Silkaatsnek*, *Smuts & Gillett* 1061. Magaliesberg Range: *Zeyher* 1849 (BOL, SAM, type gathering); *Burke* 377 ("twin type", BOL). Pretoria: Pretoria, *Leendertz* 322, 510; *Burt Davy* 2675, *Pole Evans* 30, 161; *Hutchinson* 2314. Nelspruit: *Kruger National Park*, v. d. *Schijff* 59, *Codd* 5745. Barberton: *Burt Davy*, 258. Marico: *Zeerust*, *Gerstner* 4413 (NH). Rustenburg: *Leendertz* s.n., *Pegler* 1033. Witwatersrand: Johannesburg, *Rand* 1017 (PRE, fragment of type of *Sideroxylon randii*); *Gerstner* 6418, 6424; *English* in Herb. Galpin 1486. Heidelberg: *Leendertz* s.n. (TRV, No. 8077); *Delmas*; *Naude* s.n. Brits: *Silkaatsnek*, *Smuts & Gillett* 1061; *Hartebeespoort*, *Prosser* 1297 (NBG). Magaliesberg Range: *Zeyher* 1849 (BOL, SAM, type gathering); *Burke* 377 (BOL). Pretoria: Pretoria, *Leendertz* 322, 510; *Burt Davy* 2675; *Pole Evans* 30, 161; *Hutchinson* 2314.

SWAZILAND.—*Codd* 1585; *Acocks* 12850; *Miller* S/108; *Bolus* H. No. 12110 (BOL).

NATAL AND ZULULAND.—Ngotshe: *Magut*, *Pongola*, *Gerstner* 2461; Ngome Forest Stat., *Tustin* = FD herb. No. 6552.

PORTUGUESE E. AFRICA.—Manica e Sofala: "Floresta do Garuso", *Simão* 552 (PRE: with lanceolate, petaloid epipetalous staminodes instead of stamens); Chimanimani Mts., *Plowes* 1250 (SRGH); Gorungosa, *Rodrigues de Carvalho* s.n. (COI, sterile branch, type of *Chrysophyllum carvalhoi* Engl.).

There has been some misunderstanding as regards the occurrence of the reduced sterile flowers and their proper significance. Sonder described *Chrysophyllum magalismontanum* as having normal stamens, citing *Zeyher* 1849 as the type number. Engler (1904) described *C. magalismontanum* as having female flowers with lanceolate epipetalous staminodes and oblong leaves (he cites *Zeyher* 1849 and *Burke*) and distinguished *C. wilmsii*, which is described as having leaves that are much narrowed at the base, and fertile anthers. Wright (in Fl. Cap. 4, 1: 437) distinguished these two as follows:

Leaves oblong, obtuse, obtuse at the base; flowers pedicellate,..... *magalismontanum*  
Leaves oblong, obtuse, mucronulate, acute at the base, flowers shortly pedicellate,..... *Wilmsii*

Wright made no mention of staminodes, but also cited *Zeyher* 1849 and *Burke* 377 under *C. magalismontanum*.

*Gerstner* identified the form with sterile anthers with *C. wilmsii* Engl., which is not correct, but he discovered that *C. magalismontanum* under unfavourable conditions produces depauperate flowers (*Gerstner*, op. cit. 1948, p. 171), especially after a severe drought of several months. As soon as sufficient rain has fallen the same plants develop complete flowers. The sterile stamens are sometimes transformed into lanceolate epipetalous staminodes (e.g., in *Simão* 552 and in a specimen leg. N.N. from Bulawayo = SRGH No. 5579), and the specimen *Zeyher* 1849 in the Berlin Herbarium studied by Engler is probably a branch with such abnormal flowers, whereas other specimens of the gathering *Zeyher* 1849 such as those in BOL! and SAM! (taken from other branches or other trees?) bear normal flowers and this explains the apparent controversy. I have also found that fertile and sterile stamens can occur in one flower, and

these sterile anthers, sometimes appearing as subpetaloid epipetalous staminodes are clearly abnormal, at any rate they have no taxonomic value. The difference in leaf shape as indicated in Fl. Cap. breaks down altogether as a character and *C. magalismontanum* and *C. wilmsii* are clearly synonymous.

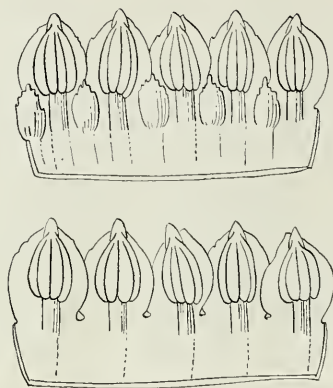


FIG. 7.—*Pouteria magalismontana*, opened corolla-tubes of two flowers of Gerstner 6418 (from Johannesburg, Transvaal), x 5, seen from the inside. Above: flower with 5 developed alternipetalous staminodes, below: flower without staminodes.

The presence or absence of alternipetalous staminodes is independent of the degree of development of the stamens and they also occur in flowers of Gerstner's forma *depauperata* (such as those of the specimen Gerstner 6424 cited by him). These alternipetalous staminodes are by no means rare; if sufficient flowers of a single specimen are dissected, some flowers with 1–5 staminodes (at least one in 10) are found. However, some specimens (or perhaps some individual plants) show a much higher frequency of flowers with developed staminodes of this type, such as Gerstner 6418 in which the majority (over 60%) of the flowers possess petaloid staminodes (see Fig. 7). Moore's type specimen of *Sideroxylon randii* (Rand 1017 in BM) is obviously such a special case. In every other respect, the description of *S. randii* and a photo of the type specimen (in J) agree perfectly with *C. magalismontanum*. Mr. de Winter, who examined the type specimen, confirmed my opinion and sent one flower of Rand 1017 which proved to be identical with *P. magalismontana*, so that *S. randii* falls into synonymy. This is a good example of the unreliability of the absence or presence of alternipetalous staminodes as a main distinguishing character in this family. Moore, after observing distinct staminodes, made it a *Sideroxylon*, whereas Sonder and Engler, who did not see distinct staminodes, referred the same species, apparently without any doubt, to *Chrysophyllum*.

As regards the identity of *P. magalismontana* and *Chrysophyllum argyrophyllum* Hiern, the differences indicated by Engler in his monograph are very slight. The differences reported are: (1) colour of the lower leaf surface (rusty-tomentose in *magalismontanum*, grey or silvery in *argyrophyllum*); (2) leaf shape (oblong to obovate-oblong in the first, oblanceolate (joblong) in the second); (3) petioles, pedicels and calyx rusty-tomentose in the first, greyish-pilose in the second. These differences are not important, because the pubescence may be rusty- or greyish-tomentose on various parts of the same specimen, older parts tending to change from rusty-brown into grey and the leaf-shape varies even in one of the original gatherings cited by Hiern: *Welwitsch* 4828

(in COI!). I have seen many specimens from Angola, Rhodesia and East Africa and there is no sharp distinction between those referred to *C. argyrophyllum* in various herbaria and those referred to *C. magalismontanum*.

The species under discussion was redescribed several times again: *Chrysophyllum antunesii* Engl. and *C. gosseweileri* De Wild. are small-leaved forms from Angola (I have seen types or isotypes of these in COI); *C. carvalhoi* Engl. is a form with narrow, lanceolate and acuminate leaves, collected in Moçambique (type in COI!).

### 3. *P. natalensis* (Sond.) A. Meeuse, comb. nov.

*Chrysophyllum natalense* Sond. in Linnaea 23: 72 (1850); Engl., Mon. Sapot. Afr. 43, t. 34, Fig. C (1904); Wood, Natal Pl. 4, t. 378 (1906); Wright in Dyer, Fl. Cap. 4, 1: 437 (1906); Sim, For. Fl. Cape Col. 252, t. 94, (1909); Gerstner in J. S. Afr. Bot. 12: 48, Fig. 2 (1946); type: *Gueinzus* 181 from Berea near Durban in herb. Sonder nunc S.

A medium-sized tree, 8–15 m. high, but often fruiting freely without much height, “growing mostly in the open or gregariously” (Sim). *Stem* up to 50 cm. in diam., with smooth bark, according to Sim and Gerstner yielding a valuable timber. *Twigs* slender, terete, grey, glabrescent; internodes decreasing in length towards the apex, so that the leaves are crowded at the tops of the twigs. *Innovations* and calyx densely dark tobacco-brown-tomentose. *Leaves* 6–12 (–15) cm. long and 2–4 (–5) cm. wide, obovate-lanceolate (ob) lanceolate-elliptic or (ob) lanceolate-oblong, shortly acuminate, acute or obtuse, at the very apex canaliculate-subdeflexed, sub-emarginate and mucronulate (occasionally in a few leaves retuse or emarginate), gradually tapering into the acute or somewhat acuminate base, when mature green (drying a characteristic greyish-green), glabrous and very shiny above, very minutely greyish- or silvery-tomentose, later sometimes glabrescent, beneath, with entire, subdeflexed and  $\pm$  undulate margins; midrib immersed and channelled above, prominent and conspicuous below; secondary nerves thin, raised, about 20 on either side, patent, almost straight, bifurcate usually well within the margin and archingly joining, no distinct intramarginal vein present; tertiary nerves inconspicuous, mostly parallel to secondary ones. *Petioles* 6–12 (–14) mm. long, canaliculate above, often brown or blackish, rugose, with two short dorsal ridges where the slightly decurrent leaf-base ends and there seemingly distinctly narrowing into the leaf-base when seen from above (at least when dry), but in fact continuous with the midrib. *Stipules* wanting or at least very early deciduous. *Flowers* sessile, in clusters of 1–3 (sometimes more) together in the leaf axils; bracts small, inconspicuous, broadly triangular, rusty-pubescent, or wanting. *Calyx*  $\pm$  4 mm. long, divided more than half way down, the segments erect, ovate, subacute. *Corolla* “white” or “yellowish”, glabrous; tube somewhat longer than the calyx, more or less constricted above the middle; the lobes suberect, ovate, obtuse, about 1 mm. long. *Anthers* subsessile, inserted at the very base of and about as long as the corolla-lobes, ovate, apiculate, not or scarcely exerted. *Ovary* depressed-globose, more or less 5-lobed, shortly pilose, contracted into the glabrous, obtuse, cylindrical style which is up to about twice as long as the ovary. *Berry* subsessile, cylindrical-ovoid or cylindrical-oblong, pointed (more or less shaped like an acorn), crowned with the persistent style, 2–2.5 cm. long and 1–1.5 cm. in diam., deep red when ripe (? also sometimes transparent white, Sim) minutely pubescent, one-seeded, edible. *Seed* ellipsoid-oblong,  $\pm$  20 mm. long,  $\pm$  8 mm. wide, and  $\pm$  5 mm. thick in the centre, with a long  $\pm$  2.4 mm. wide scar occupying the whole ventral side of the seed; testa thin, brittle.

*Distribution*.—In frostless forests in the Eastern Cape Province and Natal, from East London and Komgha northwards, also recorded from the central Transvaal, Portuguese East Africa and the eastern part of Rhodesia, and extending into tropical East Africa as far as Tanganyika or perhaps Uganda.



The type (not seen) is *Gueinzius* 181 from Berea nr. Durban, Natal (in herb. Sonder). This same number is cited by Harvey ex Wright in Fl. Cap. 4, 1: 437, together with *Sanderson* 657, *Wood* 732 and a few other gatherings. Engler (1904) cites *Gueinzius* 181 and *Medley Wood* 8950. The specimen *Wood* 732 and Engler's figure leave no doubt about its identity.

CAPE PROVINCE.—East London: near East London, *Galpin* 9284 (PRE), 9677 (PRE). Komgha: Flanagan 1138 (GRA, PRE, BOL, SAM). Pondoland: Egossa, *Sim* 2374 (NU, GRA, PRE, BOL, SAM). Kentani: *Pegler* 859 (GRA, PRE, BOL, SAM, NBG); Manubi Forest, *Story* 4475 (PRE). Willowvale: *Acocks* 12284, 12286 (PRE). Ngqeleni: *Notinsella*, FD herb. No. 1728 (SAFD); Gokama Forest: *Marais* 758. Port St. Johns: *O. B. Miller* D/88 = FD herb. No. 3864 (SAFD); Noxolweni Forest, *Mogg* 13089 (PRE).

NATAL.—Umzinto: *Dumisa*, *Rudatis* 964 (L). Pietermaritzburg: *Killick* 308 (PRE). Durban: *Sanderson* s.n. (= 657?) (PRE), *Wood* s.n. BOL, SAM = prob. Inanda, *Wood* 732, (GRA); *Marriott* PS 230 (PRE), *Thorns* s.n. (NH no. 23407), *Lavoipierre* 94 (NU). Eshowe: *Lawn* 57 (NH), *Gerstner* 1920 (NU, PRE), *Farbes* 681 (NH), *Codd* 1860 (PRE). Hlabisa: Hluhluwe Game Reserve, *Codd* 2050, *Ward* 1692 (PRE). "Zululand": *Gerstner* 2618 (BOL).

TRANSVAAL.—Pilgrims Rest: *Mariepskop*, *Killick & Strey* 2496 (PRE).

SWAZILAND.—*Miller* S. 263 (PRE).

TANGANYIKA.—Devern: *Burt* s.n. (J); Zigigler (or Zigiglen): *Burt* s.n. (J), East Usambaras: *Mlinge-Tongwe*: *Greenway* 6064.

Two specimens from Uganda (*Greenway* 6064 and *Greenway & Eggeling* 7076 in EA and PRE) are very similar if not conspecific. Two species described from E. Africa, viz. *Chrysophyllum holtzii* Engl. et Krause in Engl. Bot. Jahrb. 49: 390 (1913), and *C. tessmannii* Engl. et Krause (op. cit., p. 389) may well be synonyms of *Pouteria natalensis*.

As regards its taxonomical position, Engler placed *P. natalensis* in the subgenus or section *Gambeya* (Pierre) Engl. (= *Afrochrysophyllum* Engl. p.p.) of *Chrysophyllum*, but this species has several features which distinguish it from *Gambeya*: according to Engler's diagnosis of *Gambeya* (Engler, op. cit., p. 43), the stamens are inserted at or below the middle of the corolla-tube ("Staminum filamenta ad basin tubi vel medio libera"), the corolla lobes are ciliate (Corollae tubus lobis ciliatis aequalis vel longior) and the nervation of the leaves is different: ("... nervis lateralibus I pluribus numerosis arcuatim patentibus prope marginem sursum versis, nervis lateralibus II inter primarios obliquis"). The fruit is also different (1-seeded in *P. natalensis*, usually several-seeded in *Gambeya*, the seed-scar occupying the whole ventral side of the seed in *P. natalensis*, only the greater part of the ventral side in *Gambeya*) and, finally the ovules are basolaterally attached in *Gambeya* and distinctly laterally in *P. natalensis*. I cannot refer *P. natalensis* to any other African genus but *Pouteria* on account of the fruit characters (thin testa, large scar and lack of endosperm), in spite of the apparently constant absence of alternipetalous staminodes (which would not, however, exclude it from *Pouteria* sensu Van Royen).

Although most modern authors do not agree with Baehni's very broad conception of the genus *Pouteria*, several tropical species which fall into *Pouteria* sensu Van Royen were either overlooked, or expressly excluded from the genus by Baehni. I cannot see why these species were omitted or excluded, as Baehni did not give any reasons for his actions. It seems necessary to make the recombinations in *Pouteria*, because it may guide future workers on the flora of tropical Africa as regards my conception of the genus. This list is not complete, for only those species are included which could be studied from authentic herbarium specimens or from good plates.



***Pouteria adolfi-frederici*** (Engl.) A. Meeuse, comb. nov. *Sideroxylon* (?) *Adolfi-frederici* Engl. in Mildbr., Wiss. Ergebn. deut. Zentral-Afr. Exp. 1907-1908, 2: 519, t. 52 (1913). *Aningeria adolfi-frederici* (Engl.) Robyns & Gilbert in Robyns, Fl. Spermatophyt. Nat. Parc Albert 2: 43 (1947).

The plate and a duplicate of a syntype (named by Engler), viz., *Mildbraed* 2528 (PRE), were available for study. There is no doubt that it is a *Pouteria*.

***Pouteria cerasifera*** (Welw.) A. Meeuse, comb. nov. *Sapota cerasifera* Welw., Apontam, 585, No. 17 (1859). *Chrysophyllum cerasiferum* (Welw.) Hiern, Cat. Afr. Pl. Welw. 3: 643 (1898). *Sersalisia cerasifera* (Welw.) Engl., Mon. Sapot. Afr. 30 (1904).

***Pouteria disaco*** (Hiern.) A. Meeuse, comb. nov. *Chrysophyllum disaco* Hiern, Cat. Afr. Pl. Welw. 3: 642 (1898). *Sersalisia disaco* (Hiern) Engl., Mon. Sapot. Afr. 30, t. 10A (1904).

Mr. B. de Winter compared a few specimens from Portuguese East Africa with authentic material (*Welwitsch* 4812 in BM). Some of these are in fruit and can, therefore, be referred to *Pouteria* sensu Van Royen.

***Pouteria msolo*** (Engl.) A. Meeuse, comb. nov. *Chrysophyllum msolo* Engl., Pflanzenw. O. Afr. C., 306, t. 37 (1895). *Pachystela msolo* (Engl.) Engl., Mon. Sapot. Afr. 38 (1904).

This plant is so closely related to "*Pachystela brevipes*" that Engler did not hesitate to refer it to *Pachystela* and it is altogether incomprehensible to me how Baehni could exclude *Pachystela msolo* (in Candollea 9: 428), while referring *P. brevipes* to *Pouteria* (op. cit., 291). The same applies to the following species which is also very similar to *P. brevipes* and yet excluded by Baehni (op. cit., 428) from *Pouteria*.

***Pouteria zenkeri*** A. Meeuse, nom. nov. *Pachystela robusta* Engl. in Engl. Bot. Jahrb. 49: 386 (1913), non *Pouteria robusta* (Mart. et Eichl.) Eyma.

A true isotype, named by Engler, viz. *Zenker* 3697 (in PRE) was studied. The specific epithet "*robusta*" being preoccupied on account of an earlier combination for an American species, the name "*zenkeri*" was chosen to commemorate its first collector, well-known for his extensive West-African collections. It is strange that no reference is made to this Cameroons species in Hutchinson and Dalziel's Fl. W. Trop. Afr. vol. 2 under Sapotaceae.

#### 4. VINCENTELLA

*Pierre*, Not. botan. Sapot. 37 (1891). *Bakerisideroxylon* Engl. (as a section of *Sideroxylon*) in Engl. u. Prantl, Natürl. Pflanzenfam. ed. 1, 4, 1: 144 (1890), and in Nachträge 276 (1897); (as a genus) in Mon. Sapot. Afr. 33 (1904).

*Sideroxylon* sensu Baker in Oliv., Fl. Trop. Afr. 3: 502 (1877), pro parte.

*Bakeriella* Dubard in Lecomte, Not. Syst. 11: 89 (1911) and in Ann. Mus. Col. Marseille 20: 26 (1912), pro parte.

*Pouteria* Aubl. sectio *Bakerisideroxylon* (Engl.) Baehni in Candollea 9: 382 (1942).

Type species: Baehni, in Candollea 7: 497 (1938), p. 497, mentions as the type species *Vincentella longistyla* (Baker) Pierre, Not. Bot. Sapot. (1891), p. 37. However, this is a synonym of *Pachystela brevipes* and as *Pachystela* was only validly published in 1904, *V. longistyla* at the same time being removed from *Vincentella* and transferred to *Pachystela* by Engler, the type species of *Vincentella* must be among the other two species mentioned by Pierre and retained in *Bakerisideroxylon* by Engler, viz., *V. densiflora* (Baker) Pierre and *V. revoluta* (Baker) Pierre. Priority of place would indicate *Sideroxylon densiflorum* Baker = *Vincentella densiflora* (Baker) Pierre (from San Tomé Island) as the type species, as was rightly pointed out by Exell in Cat. Vasc.

Pl. S. Tomé 235 (1944).

Shrubs or trees. *Leaves* generally oblong, with usually rather distant prominent secondary nerves and fine tertiary reticulate nervation. *Stipules* early deciduous. *Flowers* small, 5-merous, in many-flowered fascicles in the leaf axils and especially in the axils of fallen leaves on the twigs; pedicels very slender to capillary often rather long and more or less pendulous. *Sepals* small, free nearly to the base, later patent or reflexed. *Corolla-tube* very short, the lobes many times longer, elongate-oblong or linear-oblong, strongly reflexed. *Staminodes* and *stamens* inserted at the throat of the corolla-tube. *Alternipetalous staminodes* narrowly linear, inserted between and about as long as the corolla-lobes (but erect), entire or rarely dentate-serrate, acute or acuminate. *Filaments* filiform, erect, several times longer than the oblong-sagittate, minutely apiculate anthers. *Ovary* large, ovoid, villous, contracted in the usually rather long and filiform-cylindric, glabrous style, 5-loculated; ovules with lateral attachment, pendulous. *Fruit* oblong-ovoid, 1-seeded with 4 sterile loculi. *Seeds* oblong; testa crustaceous; scar long, linear, occupying the upper part of the ventral side of the seed; cotyledons thick and fleshy, endosperm membranous or absent.

An African genus of four species, one species extending into Southern Africa.

As Baehni, l.c. pointed out, *Vincentella* Pierre (1891) was legitimately published as a genus, although it corresponded with a section *Bakerisideroxylon* (1890) distinguished by Engler in the genus *Sideroxylon* which was later (1904), given the status of a genus by Enger. Pierre was not compelled to take up Engler's section name when he established a new genus and *Vincentella*, therefore, stands.

The typical slender pedicels, reflexed narrow corolla-lobes and very short corolla-tube, the fairly large ovary, erect long anthers and long staminodes make it possible to recognise a species of *Vincentella* almost at once. Baehni retains *Vincentella* as a section *Bakerisideroxylon* of his large genus *Pouteria* Aubl. sensu Baehni, but it is so distinct that, in my opinion, it deserves generic rank.

**V. sapinii** (De Wild.) Brenan in Mem. New York. Bot 8: 498 (1954).

*Bakerisideroxylon sapinii* ("Sapini") De Wild. in Rev. Zool. Afr. 7, suppl. bot. B 16 (1919), and in Pl. Bequart. 4: 116 (1926), type: *Sapin* s.n. BR, holo.; K, iso.

*Pouteria tridentata* Baehni in Candollea 9: 386 (1942); type: *Stolz* 1889 from Tanganyika in G, holo.; K and PRE, isos.

*Bakerisideroxylon stolzii* Mildbr. Ms.

*Vincentella stolzii* (Mildbr. Ms. ex) Hutch., Botan. South Afr. 506 (1948), nomen nudum.

*General Distribution*.—Southern Tanganyika, Nyasaland and the Niassa Province of Portuguese East Africa, Northern Rhodesia and Belgian Congo, seems to prefer streambanks (teste Gomes e Sousa, Benson, Brass).

NYASALAND.—Kota-Kota distr.: Benson 257, 765 (PRE); Chia area, Brass 17510 (PRE).

PORTUGUESE E. AFRICA.—Niassa: Nampula distr., Ribáuê, Gomes e Sousa 2305 (PRE).

TANGANYIKA TERRITORY.—Kymbila: *Stolz* 1889 (isotype of *Pouteria tridentata* Baehni, PRE).

"A shrub or small tree, 4–6 m. high". (Gomes e Sousa). *Young* branches terete, densely rusty-tomentose-hirsutulous, later becoming shortly and more greyish-tomentose, the older ones ultimately glabrescent. *Leaves* oblanceolate-oblong to obovate-oblong,

with obtuse, rounded or emarginate apex and attenuated-cuneate base, with reflexed margin, 4–10 cm. long, 3–5 cm. wide (according to Baehni: 10–14 cm. long and 3–5 cm. wide), chartaceous or subcoriaceous, soon glabrous, rather shiny above, paler and duller beneath; midrib impressed and keeled above, very prominent and when dry longitudinally sulcate below, glabrescent but retaining the original tomentum somewhat longer than the rest of the blade; secondary nerves impressed above, prominent below, 8–12 on either side, rather distant (4–10 mm. apart), at first rather straight, ascending at an angle of  $45^{\circ}$ – $70^{\circ}$ , arcuate-ascending near the margin and reaching it except those near the apex; tertiary nerves inconspicuous above, subimpressed and rather distinct below, slender, mainly perpendicular to the secondary ones; ultimate nervation very fine reticulate, tessellate, rather distinct at least below. *Petioles* stout, densely rusty-tomentose-hirsutulous, 3–10 mm. long, flattened and canaliculate above. *Stipules* linear-subulate 4–5 mm. long, deciduous. *Flowers* fragrant (teste Benson). *Pedicels* 5–7.5 mm. long, hirsute, terete, slightly widening under the calyx. *Sepals* ovate-triangular, hairy outside glabrous inside, about  $1\frac{1}{2}$  mm. long. *Corolla* white (teste Gomes e Sousa and Benson) glabrous, lobes narrowly-oblong, obtuse,  $\pm 3$  mm. long  $\pm 1$  mm. wide. *Staminodes* linear, acute, about as long as the corolla-lobes, with or a few small or minute lateral teeth. *Filaments* slender, 2.5–3 mm. long, the anthers  $\pm 0.5$  mm. long. *Ovary* ovoid-conical, hirsute,  $\pm 1\frac{1}{2}$  mm. long and  $\pm 1$  mm. in diameter, attenuated into the long-subulate-linear, sulcate (at least when dry), subacute and glabrous  $1\frac{1}{2}$ –2 mm. long style. *Fruit* and *seed* not seen but fruit reported by Brass to be yellow, soft and edible.

## 5. LECOMTEDOXA

(Engl.) Dubard in Ann. Mus. Col. Marseille 23: 31 (1915); Baehni in Candollea 7: 456 (1938); Lam in Blumea 4: 348, 350 (1941).

*Minusops* subgenus *Lecomtedoxa* (Pierre ex Engl., Mon. Sapot. Afr. 82, t. 24, Fig. A. (1904).

*Minusops* subgenus *Quaternaria* sectio *Inhambanella* Engl., op. cit., 80; Pilger in Engler & Prantl, Natürl. Pflanzenfam., ed. 1, Nachträge 1897–1904), exclus. descr. of the flowers.

*Inhambanella* (Engl.), Dub., tom., cit., 42, as to type species.

Type species.—*Minusops kleiniana* Pierre ex Engl., Mon. Sapot. Afr. 82 (1904) = *Lecomtedoxa kleiniana* (Pierre ex Engl.) Dub. in Ann. Mus. Col. Marseille 23: 31 (1915). /a

Small to very large trees. *Leaves* more or less distinctly crowded at the tips of the branchlets, coriaceous, more or less shiny above, paler and dull beneath. *Flowers* in few to many-flowered fascicles in the axils of the leaves or of leaf-scars below the leaves. *Calyx*-lobes 4–6; sometimes 3, sometimes unequal and subbiseriate, more or less erect, more or less concave. *Corolla* isomerous with the calyx; the tube short to rather long the lobes with each 2 lateral appendages (sometimes with only one appendage); the appendages entire, either very broad and larger than the lobes, or small. *Alternipetalous staminodes* lanceolate to ovate-lanceolate or long-triangular (resembling those of *Sideroxylon*), rather large and conspicuous, alternating with the corolla lobes. *Stamens* inserted in the throat of the corolla-tube or slightly higher up; filaments short or rather long; anthers apiculate, included or slightly exerted. *Ovary* 5(-6)-loculate, hairy; ovules with lateral attachment; style glabrous, rather short, either capitate or tapering at the apex. *Fruit* 1-seeded, rather large. *Seed* with long scar occupying the ventral side of the seed; testa crustaceous; endosperm O or very thin; cotyledons thick and fleshy.



*General Distribution.*—2 or 3 species in tropical West Africa, one in Portuguese East Africa and Zululand.

*L. henriquesii* (Engl. et Warb.) *A. Meeuse*, comb. nov.

*Mimusops henriquesii* Engl. et Warb. in Engl., Mon. Sapot. Afr. 80 (1904). (sphalm. "*henriquezii*", cf. "Corrigenda", op. cit., p. 88); type: *Rolla Ferreira* s.n. from Portuguese East Africa in COI, holo! *M. henriquesiana* (Sphalm.?) Sim, For. Fl. Port. E. Afr. 80, t. 77, A (1909); Gerstner in J. S. Afr. Bot. 12: 54 (1946).

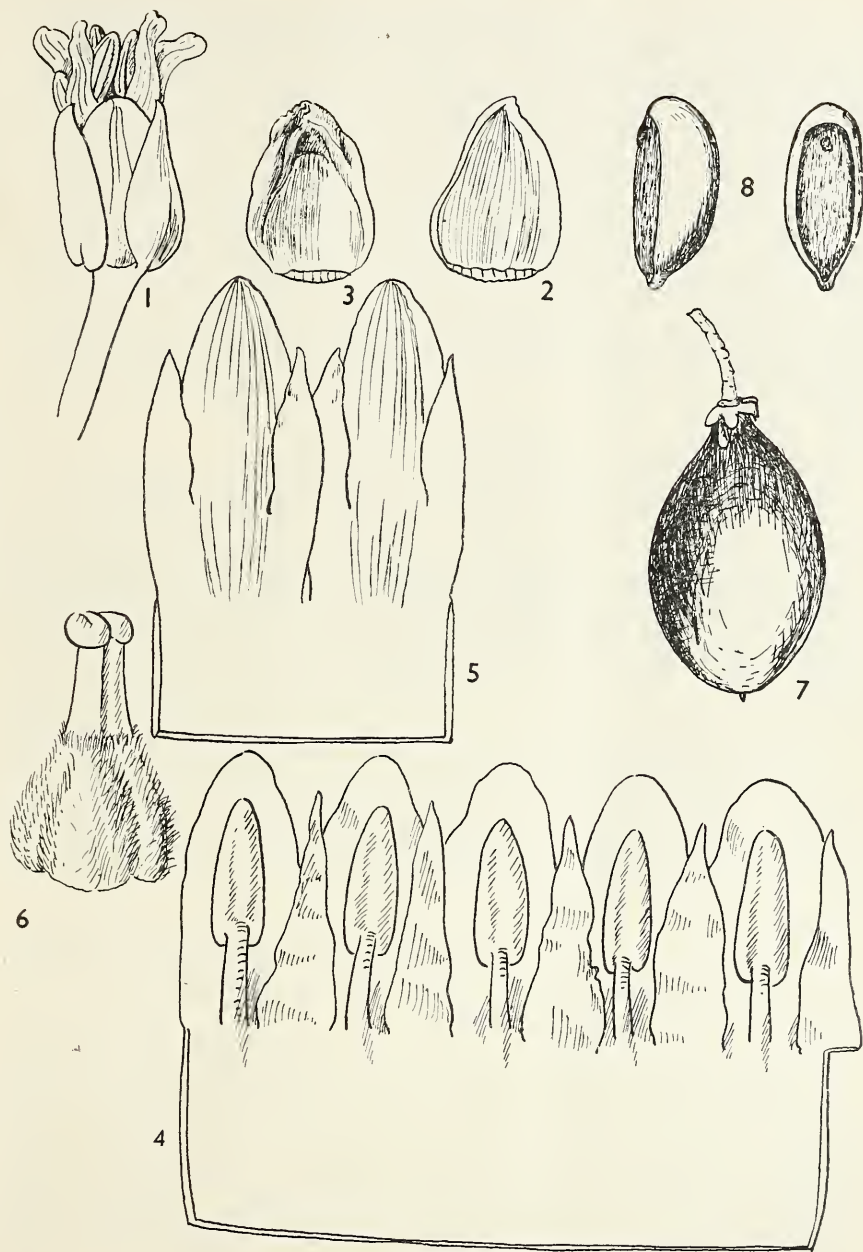
*Inhambavella henriquesii* (Engl. et Warb.) Dub. in Ann. Mus. Col. Marseille 23: 42 (1915).

As Engler's and Sim's descriptions are very incomplete and the flowers had hitherto not been known, a very detailed description is given.

Small to medium-sized tree, up to 20 m. high, with spreading branches and abundant heavy foliage. *Branches* rather stout, terete, longitudinally striate and sulcate, soon quite glabrous, greyish-born, later turning light grey and usually marked with scars. *Innovations* rusty-tomentose, but vegetative parts soon quite glabrous. *Stipules* subulate-falcate, pubescent, 3–7 mm. long, early deciduous. *Petioles* rather strongly canaliculate above and with a very narrow dorso-lateral wing or ridge on either side (which is a continuation of the edges of the decurrent leaf-base), when dry longitudinally sulcate, 12–35 (–52) mm. long. *Young growths* bright red to red-brown. *Leaves* varying from oblanceolate-oblong to oblong or obovate-oblong, obovate or broadly elliptic, coriaceous but rather thin, green (drying pale green or greyish green), 5–12 (–17) cm. long and  $2\frac{3}{4}$ –5 (–8) cm. wide, with obtuse, rounded or bluntly acuminate, often distinctly emarginate and more or less deflexed apex, acute or somewhat attenuate and slightly decurrent at the base, with reflexed margin, the edges often more or less undulate; almost invariable some leaves of each specimen with raised round flat or semiglobose galls; midrib impressed and keeled above, very prominent and when dry longitudinally sulcate below; secondary nerves 6–9 on either side, rather distant (5–10 mm., sometimes up to 25 mm. apart), not very conspicuous and often subimpressed (but sometimes slightly raised) above, usually prominent and more conspicuous below, slender, at first patent (ascending at angles between 45° and 90°), but mostly soon arcuate-ascending, the majority very strongly curved, becoming more or less sinuous and parallel with the edge of the leaf, ultimately reaching the nerve above it and thus forming a more or less distinct intra-marginal vein close to the margin, but some bifurcate or archingly joining; tertiary nerves more or less perpendicular to the midrib and joining the secondary ones, forming a coarse reticulation which is slightly prominent below; ultimate nervation very fine, reticulate, usually conspicuous at least on the lower surface. *Flowers* in few to many-flowered fascicles; bracts ovate, usually strongly concave to almost keeled and acute, 1–3 mm. long, pubescent; pedicels 5–20 mm. but usually 10–15 mm. long, terete or slightly angular, brownish-tomentose, rather abruptly widening into the calyx. *Sepals* 5 (or 4 to 6) erect, more or less concave, 4–5 mm. long, unequal to sub-biseriate; the outer 2–3 ovate-triangular from a broad base, 3–4 mm. wide, subacute, brownish-tomentose outside and inside near the margin and towards the apex; the inner ones thinner in texture, ovate-oblong, elliptic or broadly

FIG. 8.—*Lecomtedoxa henriquesii*, 1: Flower, x 5; 2: outer sepal; 3: inner sepal; 4: corolla tube, opened and seen from inside, x 10; 5: part of corolla tube seen from outside, showing the lateral appendages, x 10; 6: ovary, x 10. 7: fruit and 8: seed (7 and 8 from the type specimen, *Ferreira* s.n. in COI).





oblong, with a narrower base, obtuse or rounded at the apex, pale fawnish-tomentose-sericeous outside, glabrous inside, finely ciliate along the margin, usually only 2–3 mm. wide. *Corolla* glabrous, yellowish or white; the tube cylindric-campanulate, about 3 mm. long, the inside with distinct thickened lines below the stamens and the staminodes; the lobes elliptic or elliptic-oblong, 4.4–5 mm. long, and 2–3 mm. wide; lateral appendages shorter than or as long as the corolla-lobes, attached near the middle of the corolla-lobes or near the base, usually asymmetrical, ovate-lanceolate to lanceolate-falcate, 1–4 mm. long. *Alternipetalous staminodes* ovate-lanceolate or lanceolate to elongate-triangular, often somewhat undulate, entire, acute, or obtuse, glabrous, about 3 mm. long. *Stamens* inserted on the corolla-lobes slightly above the throat of the tube; filaments linear, 1–2.5 mm. long, glabrous, more or less winged and often with broad somewhat auriculate base; anthers oblong, minutely apiculate, 1.5–2.5 mm. long. *Ovary* ovoid-conical, about 1.5 mm. long and 1.5–2 mm. in diameter, more or less distinctly lobed, densely greyish-tomentose, usually 5-loculated; style glabrous, thick, columnar, terete or somewhat angular, about 1.5 mm. long and 0.5 mm. thick; stigma capitate, indistinctly 5-lobed and sometimes also bilobed. *Fruit* ellipsoid, about 4 cm. long and 2–2.5 cm. in diameter. *Seed* oblong, somewhat compressed, about 3 cm. long, 1.5 cm. wide and 1.2 cm. thick; testa crustaceous, shiny, scar oblong, about 28 mm. long and 6 mm. wide; cotyledons about 5 mm. thick.

ZULULAND.—Hlabisa: False Bay (according to Gerstner, l.c.; no specimen seen); St. Lucia Estuary, *Ward* 441 (NU); Mdlozi Peninsula, *Ward* 3032 (PRE).

PORTUGUESE E. AFRICA.—Sul do Save: Maputoland, Santaca; *Gomes e Sousa* 3816 (COI, PRE). Manica e Sofala: Inhambane, *Rolla Ferreira* s.n. (COI, type); *Beira*, Vila Fontes, leg. *N.N.*, Laboratório Químico Herbario No. 77 (SRGH); Chissadze, Cheringoma, *Simão* 1559 (PRE); Dondo Junction, *Honey* 871 (BOL, PRE). Zambezia: Quelimane, between Mopeia and Morumbala, *Barbosa & Carvalho* 3960 (PRE). Locality not known to me (near Inhambane?): Maguiya da Costa, *Sim* 20911 (PRE).

The type is a specimen leg. *A. J. Rolla Ferreira* in 1903 (s.n.), “Regiões de Gaza e Inhambane”, but most probably from Inhambane, Portuguese East Africa, because Engler named it “*Inhambanella*” and *Sim* (l.c.) mentions “*Ferreira’s* farm near Inhambane” as the place of origin. Engler erroneously mentioned: “Herb. Univ. Cordoba” instead of “Herb. Univ. Coimbra” as the location of the type specimen. *Sim* refers to this plant as “*Mimusops henriquesiana*” but as he mentions *Ferreira’s* farm and the specific epithet is so similar, I am of the opinion that “*henriquesiana*” is a *lapsus calami* for “*henriquesii*”.

As regards the identity of *Mimusops henriquesii* and the other specimens cited above, the only fruiting specimen that I could study was the type, but the vegetative parts and the calyx agree in every respect with those of the flowering specimens cited here so that I feel certain that the identification is correct.

The species under discussion differs from the West African representatives of *Lecomtedoxa*, in that the lateral appendages are small and the fruit is only slightly attenuate near the base (in the W. African species the lateral appendages are larger than the corolla-lobes, and the fruits are markedly attenuate at the base). In all other essential characters, the South African species agrees very well with the West African ones, such as the structure of the calyx, the staminodes, the attachment of the ovules, the one-seeded fruit, and the seeds with long ventral scar and without (or with very scanty) endosperm. I see no reason to create a separate genus nor even a subgenus or section for the South African species, because the differences are only relative ones and, in my opinion, not at all important.

*Lecomtedoxa* is a remarkable genus in that it combines the possession of lateral appendages with (usually) 5-merous flowers, a monoseriate calyx (which, however, tends to be biseriate) and seeds with long scar (ovules with lateral attachment), and it forms a veritable link between the subfamily *Minusopoidea* H. J. Lam (with biseriate calyces and 3-merous or 4-merous flowers) and the subfamily *Sideroxyloideae* H. J. Lam (with usually 4-merous flowers, and monoseriate calyx); especially the tribe *Pouterieae* H. J. Lam (which also has long seed-scars). The only other genera in which 5-merous flowers are found, combined with the presence of lateral appendages and monoseriate calyx, are the American genera *Bumelia* and *Dipholis*, of the *Sideroxyloideae-Bumelieae*. These two genera show great affinities to the genus *Sideroxylon* and certainly deserve their place in the *Sideroxyloideae*. *Lecomtedoxa* on the other hand, shows distinct affinities with the *Minusopoideae* (subbiseriate calyx) and should, in my opinion be retained in this subfamily as was done by Dubard and by Lam.

In a note on Ward 3032 the collector mentions that the young growths (young leaves) are bright-red to red-brown which makes the trees quite conspicuous in spring.

## 6. AUSTROMIMUSOPS

A. Meeuse, gen. nov. *Inhambanella* Dubard, in Ann. Mus. Col. Marseille 23: 42 (1915), pro parte, non *Mimusops* Subgenus *Quaternaria* sectio *Inhambanella* Engl. in Mon. Sapot. Afr. 80 (1904). *Mimusops* Auct., pro parte.

Arbores vel frutices. *Folia* chartacea vel subcoriacea, conspicue ad apices ramulorum conferta; foliorum nervi secundarii et tertiarii atque venae tenuae, dense subtiliter reticulatae. *Flores* 1-4 in axillis ad apices ramulorum (3-) 4 meri. *Sepala* (3 + 3 vel) 4 + 4, rarissime 5 + 5, elongata-triangularia vel lineari-oblonga vel lineari-lanceolata exterioribus et interioribus subaequilongis extus tomentosis, acutis vel interioribus obtusis, interioribus pallidioribus. *Corollae* tubus brevis; segmenta (6-) 8 appendiculis binis integris instructa. *Stamina* fertilia (6-) 8, staminis filamenta antheris breviora; antherae oblongo-lanceolatae vel lanceolatae connectivo apiculato. *Staminodia* elongata-triangularia vel lanceolata, integra vel interdum ad apicem plus minusve dentata, extus pilosa. *Ovarium* ovoideum vel subglobosum, hirsutum (6-) 8 loculare; ovula ad medium loculorum vel basi-laterale affixa; stylus exsertus, cylindricus vel subulatus vel filiformis, glabrus. *Bacca* ovoidea vel ellipsoidea, apiculata, monosperma raro 2-sperma. *Semen* ellipsoideum; area detersa (= cicatrix) magna, lata, semen longitudine subaequalis; testa crustacea vel plus minusve pergamacea; albumen nullum; cotyledones plano-convexae, crassae.

Type species: *Mimusops marginata* N. E. Br. (= *M. natalensis* Schinz non Engl.) = *Austromimusops marginata* (N.E. Br.) A. Meeuse.

Large shrubs or small to medium-sized trees with the leaves crowded at the very tips of the, often thick, branches. *Leaves* exstipulate, firm, but usually not coriaceous, not very shiny above, with a very fine tessellated reticular nervation which is always conspicuous at least on one side. *Petioles* distinctly, and usually widely, canaliculate above. *Flowers* in the axils of the leaves or of scaly bracts, 1-4 together, but as the leaves are crowded at the tips of the branches, apparently forming dense umbels of up to 20 flowers and over. *Pedicels* usually more or less pendulous. *Calyx* biseriate, the lobes free nearly to the base, (3 + 3 or) 4 + 4, very rarely 5 + 5, 3- and 4-, or 4- and 5- merous calyces occurring in one specimen; outer calyx lobes thicker and usually broader than the inner ones, which also differ in pubescence and are more or less distinctly midribbed. *Corolla* 3-merous and 4-merous (also occasionally 5-merous?) in one specimen, or 4- merous; the tube very short; the lobes and lateral appendages subequal. *Stamens* (6 or) 8, resembling those of *Mimusops*, i.e., the anthers longer



than the filaments, apiculate. *Staminodes* as in *Mimusops*, i.e., not deeply incised, lobed or fimbriate, usually quite entire, concave, hairy outside. Ovary 6- or 8-loculated, usually subglobose; ovules with lateral or sometimes basi-lateral attachment; style terete, subacute or subtruncate at the apex. *Fruit* one-seeded, rarely 2-seeded. *Seed* with rather thin, crustaceous or tough almost pergamaceous testa and a large broad scar occupying nearly the whole ventral side of the seed; endosperm absent; cotyledons thick and fleshy.

The genus contains at least four species, three found in Southern Africa, and one in tropical East Africa.

Engler, l.c., based his section *Inhambanella* of *Mimusops* on a specimen without flowers, mainly on the characters of the seed. Dubard, l.c., noticed that the ovules of the species *Mimusops natalensis* Schinz non Engl. (= *Mimusops marginata* N.E. Br.) are laterally attached and concluded that these ovules would give rise to seeds with a long lateral scar, so that this species could not be a true *Mimusops*. Although Dubard did not study the type specimen of *Mimusops henriquesii* (the type of Engler's section *Inhambanella*), he referred *Mimusops natalensis* Schinz to *Inhambanella*, which he raised to generic rank. This was a conjecture, because the flowers of *M. henriquesii* were unknown and Dubard had not seen the seed of *M. natalensis* Schinz.

However, *Mimusops henriquesii* is, in my opinion, a species of *Lecomtedoxa* (see p. 344) and therefore, the name *Inhambanella* either as a subgenus or as a genus being typified by *Mimusops henriquesii* Engl. et Warb., becomes a synonym of the genus *Lecomtedoxa* (Engl.) Dub. Dubard was, to my mind, quite right in excluding *M. natalensis* Schinz from *Mimusops*, but the name *Inhambanella* Dub. cannot be used for it and the congeneric forms, included here in *Austromimusops*. The affinities of *Austromimusops* are most probably with *Baillonella* Pierre which it resembles in floral characters, which are also very similar to those of *Mimusops*, but from which it differs in the absence of endosperm (*Baillonella* has a thin layer of endosperm), and the thin crustaceous to pergamaceous testa (thick and bony in *Baillonella*), and with the more or less dubious genera *Dumoria* Chev. and *Tieghemella* Pierre (= ?*Dumoria*).

Although the floral characters are very similar to those of *Mimusops*, there are so many differences that the generic distinction is not very difficult. The vegetative characters alone are almost sufficient to typify *Austromimusops*, apart from the characters of the seed. The following table (see Table II) shows the differences between the genera *Mimusops* s.s., *Austromimusops*, *Baillonella* and *Manilkara*. *Dumoria* and *Tieghemella* are not included, because it is very likely that they are identical with *Baillonella*, at any rate the characters of fruit and seed are apparently the same as those of *Baillonella*.

Leaves usually more than 6 cm. long, petiole usually over 10 mm. long. Pedicels 2-5 cm. long.....	1. <i>A. marginata</i> .
Leaves (at least the majority) under 6 cm. long, petiole 3-8 mm.; rarely up to 10 mm. long. Pedicels 0.9-2 cm. long:	
Young parts, pedicels and calyces buffy-brown pubescent. Leaves $\frac{3}{4}$ -2 (-2 $\frac{1}{2}$ ) cm. wide, soon quite glabrous. Petioles soon glabrous. Pedicels 9-16 mm. long. Calyx-lobes 5-6 mm. long. Natal.....	2. <i>A. dispar</i> .
Young parts, pedicels and calyces rusty-pubescent. Leaves $1\frac{1}{2}$ -3 $\frac{1}{2}$ (-4 $\frac{1}{2}$ ) cm. wide, often showing vestiges of the rusty brown pubescence. Petiole often rusty-tomentose. Pedicels usually $1\frac{1}{2}$ -2 cm. long. Calyx-lobes $\pm$ 7 mm. long. E. Southern Rhodesia.....	3. <i>A. sylvestris</i> .

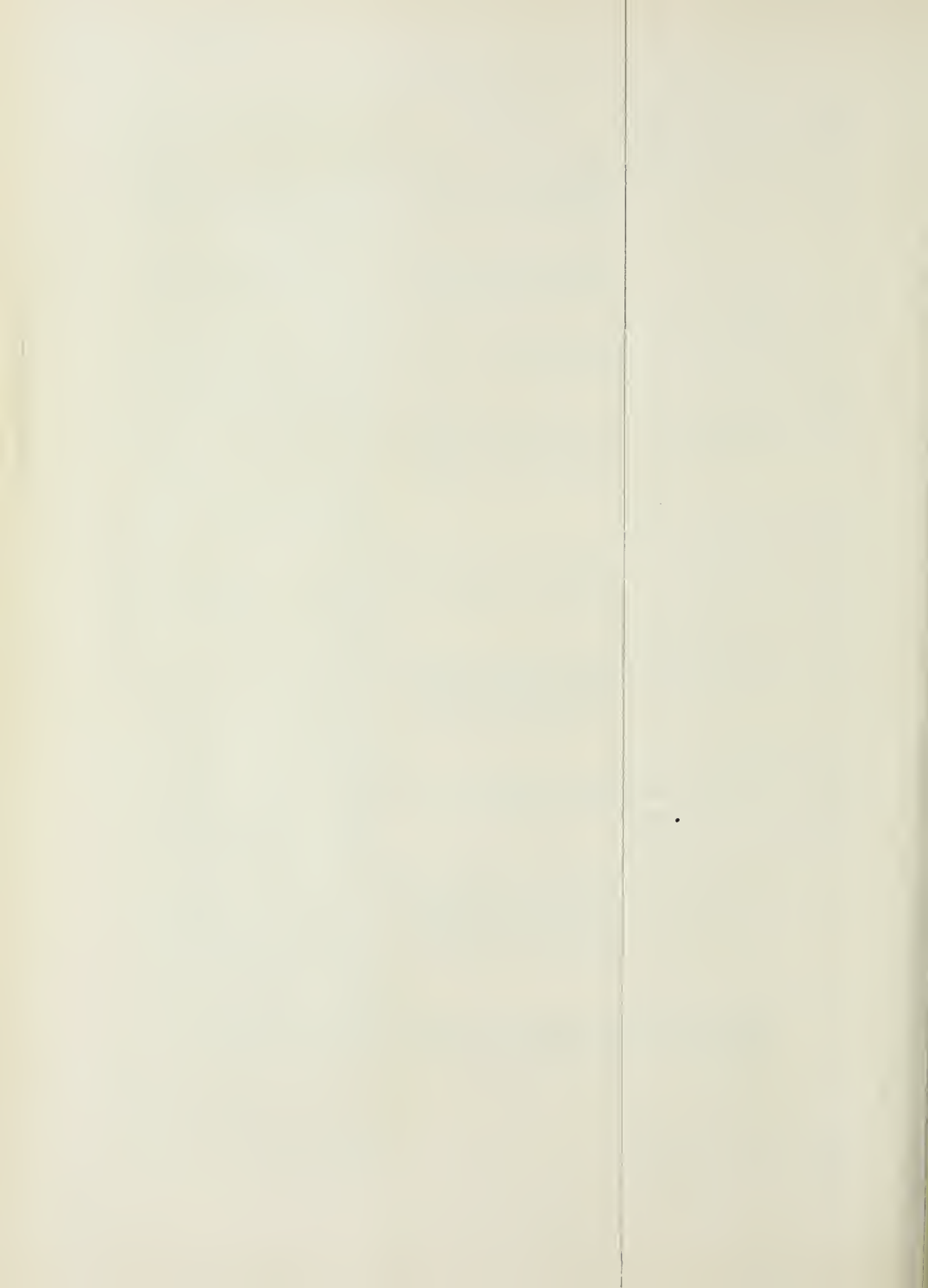
**1. *A. marginata* (N.E. Br.) *A. Meeuse*, comb. nov.**

*Mimusops marginata* N.E. Br. in Kew Bull. 108 (1895); Engl., Mon. Sapot. Afr. 71 (1904); Wright in Dyer, Fl. Cap. 4, 1: 441 (1906); Sim, For. Fl. Cape Col. 254, pl. 97, Fig. 1 (1907); Gerstner in J. S. Afr. Bot. 12: 54, Figs. 8, 9 (1946); type: *Flanagan* 27, K, lecto., BOL, GRA, NBG, PRE. isos! *M. natalensis* Schinz in Bull.



TABLE II.

	Mimusops.	Austromimusops.	Baillonella.	Manilkara.
1. Leaves.....	Scattered on the branches, coriaceous, smooth and shiny above, exstipulate.	Terminal on the branches firm but usually not coriaceous, not smooth and rather dull above, exstipulate.	Terminal on the branches, subcoriaceous, very large, smooth and shiny above, stipulate.	Almost invariably $\pm$ terminal on the branches, coriaceous or not, smooth and shiny above or dull $\pm$ and rough, exstipulate.
2. Nervation.....	Various but not distinctly parallel and rather lax without a very fine areolate tessellate nervation	Secondary nerves and tertiary nerves rather few, ultimate nervation very fine, tessellate, distinct.	Secondary nerves parallel, numerous; ultimate nervation areolate, distinct.	Secondary nerves usually numerous, parallel, fine reticulate nervation often present.
3. Calyx.....	Biseriate: always 4 + 4, the lobes rather long ( $\pm$ lanceolate)	Biseriate: 3 + 3, 4 + 4 or 5 + 5, the same specimen showing 3- and 4-merous calyces, the lobes as in <i>Mimusops</i>	Biseriate, 4 + 4, the lobes as in <i>Mimusops</i>	Biseriate, usually 3 + 3, sometimes 4 + 4, or 3 + 3 and 4 + 4 on one specimen the lobes relatively broad and rather short.
4. Corolla.....	8 lobes + 8 $\times$ 2 lateral appendages; appendages entire or dissected.	6 or 8 lobes with 12 or 16 appendages, respectively; 3-merous and 4-merous flowers on one specimen; appendages entire.	8 lobes with 8 $\times$ 2 appendages; appendages entire	Usually 6 lobes + 6 $\times$ 2 appendages; more rarely 8 + 8 $\times$ 2, appendages, sometimes 6 + 6 $\times$ 2 and 8 + 8 $\times$ 2 in one specimen; appendages entire; rarely appendages O.
5. Stamens.....	Stamens 8, Filaments shorter than the stamens, anthers (rather) long and narrow.	Stamens 6 or 8. Filaments and anthers as in <i>Mimusops</i>	Stamens 8. Anthers and filaments about as long, anthers rather wide and rather short.	Stamens 6, more rarely 8, sometimes 6 or 8 on one specimen. Filaments usually longer than anthers, the latter relatively short.
6. Staminodes.....	8, entire or serrate at the apex only, usually pubescent and incurved so as to cover the pistillum.	6 or 8 (on one specimen), as in <i>Mimusops</i> , entire or slightly fimbriate at the apex, hairy outside and incurved, covering the pistillum.	8, widened at about 1/3 from the base, hairy outside in the basal part, upper part spreading with the petals.	6, 8 or 6 and 8 sometimes less short or long, but almost invariably glabrous and laciniate, dentate, fimbriate or $\pm$ dissected, erect with the stamens or patent with the petals.
7. Carpels and ovules	Ovary 8- (rarely 16-) loculated; ovules basally affixed.	Ovaries can be 6- and 8-loculated in one specimen; ovules laterally affixed.	Ovary 8-loculated; ovules laterally attached.	Ovary 15-6-loculated (usually 6-loculated; in 4-merous flowers 8-loculated), ovule usually ventrally affixed, more rarely almost basal.
8. Fruit and seed (cicatrix and testa)	Fruit 1- to several-seeded; scar almost invariably small, circular and almost basal; testa hard, bony, shiny.	Fruit 1-seeded rarely 2-seeded; scar very large, ventral, occupying $\pm$ the whole length of the seed; testa leathery or crustaceous, not hard, dull	Fruit 1-seeded, large; scar very large, occupying the ventral half of the seed; testa thick, hard and bony, shiny.	Fruit 1- to several-seeded scar basiventral, relatively long and narrow, more rarely broader and ovate or $\pm$ circular and almost basal, testa usually hard, bony and shiny, sometimes crustaceous.
9. Embryo and endosperm	Endosperm copious; cotyledons thin, foliaceous.	Endosperm O; cotyledons thick and fleshy.	Endosperm thin; cotyledons thick and fleshy.	Endosperm copious; cotyledons thin, foliaceous.



Herb. Boiss. 4: 441 (1896); type: *Schlechter* 6220 in Z. "*M. transvaalensis* Schinz" (sphalm.), Radlk. in Zahlbr., Pl. Penther. I, in Ann. K.k. Naturh. Mus. Wien 15: 63 (1900). *M. schinzii* Engl. op. cit., 70, t. 29, Fig. A; Wright, op. cit., 443, Gerstner, l.c., 54 (same type as *M. natalensis* Schinz).

*Inliambanella natalensis* (Schinz) Dubard in Ann. Mus. Col. Marseille 23: 42 (1915).

A tree found in rather moist forests. *Stem* straight, 6–20 m. high and 30–60 cm. in diam. *Branches* terete, grey, more or less rough; ultimate branches short and rather stout, usually over 3 mm. thick, often much thicker, glabrous. *Innovations* densely rusty tomentose-villous, but all vegetative parts soon quite glabrous. *Leaves* obovate or elliptic-obovate, sometimes elliptic-oblong or elliptic-(ob)lanceolate, thinly coriaceous with a dull shine (but not smooth) and drying a greyish green (rarely brown) above, paler and duller below, 3–15 (usually 6–13) cm. by 2–9 cm., as a rule more or less acuminate with obtuse apex, a narrowed or somewhat rounded base and subreflexed margin; midrib distinct but not conspicuously keeled or channelled above, prominent below; lateral nerves slender but prominent beneath; ultimate nervation very fine, reticulate, usually conspicuous on at least one surface. *Petioles* (5–) 10–20 mm. long, rather stout, semi-terete, strongly and widely canaliculate. *Flowers* 1–3 in axils of leaves and of scales inside them, more or less pendulous on 2–5 cm. long pedicels, 3-merous or 4-merous. *Calyx* biseriolate, outer lobes rusty-pubescent, inner ones pale-pubescent, all acuminate, acute, 7.5–12 mm. long. *Corolla* dull white; tube 1–2 mm. long, pubescent outside, lobes and appendages subequal, 6–9.5 mm. long. *Staminodes* 6–8, densely villous outside, 4.5–5.5 mm. long. *Stamens* 6–8 mm. long. *Ovary* 6- of 8-celled; style 9–11 mm. long. *Fruit* rather large, ovoid or ellipsoid, apiculate or attenuate-apiculate, pointed, ultimately glabrous, purplish red, up to 5 cm. long and 3½ cm. diameter, on the slightly incrassate, but not lengthened pedicel; fruiting calyx spreading-reflexed. *Seed* broadly ellipsoid, 20–25 mm. long, about 20 mm. wide and about 18 mm. thick; testa crustaceous, dull, pale buff when dry; scar somewhat shorter than the seed, occupying about half its surface area, elliptic or oblong in outline, emarginate at the apex and about 20 mm. broad in the widest place.

N. E. Brown did not designate a type specimen but Mr. de Winter informed me that the only specimen at Kew with fruits is *Flanagan* 27, so that most probably the fruits were described from this specimen. Accordingly, I propose *Flanagan* 27 (in K) as the lecto-type. Type locality: Komgha, E. Cape.

*Distribution*.—From East London northwards into Natal, Zululand and Portuguese East Africa, just crossing the Transvaal border.

CAPE PROVINCE.—East London: *Sim* 2182, 2183, 2190 (= ?2194 collect. No.) (NU), 2194 (BOL), 2602, s.n. (PRE); *Acoks* 10979, 12298 (PRE), *Courtney Latimer* s.n. (PRE), *Rattray* 1371 (BOL). Komgha: Gwenkala, *Flanagan* 27 (PRE, GRA, BOL, SAM, isotypes); *Schlechter* 6220 (GRA, isotype of *Mimusops natalensis* Schinz = *M. schinzii* Engl.). Kentani: *Pegler* 692 (PRE, BOL, NBG).

NATAL.—Port Shepstone: near Mehlomnyama, *Marais* 7871 (PRE). Umzinto: Dumisa, *Rudatis* 450 (L). Pinetown: Dellville, *Smuts* s.n. (NH No. 17830); Warner Beach, *Ward* 977 (NU, PRE); Amanzimtoti, *Williams* 65 (NU); Marianhill, *Forbes* 1041 (NH); Umlaas, *Wood* 5440 (NH); *Kotze* 436 (PRE) = FD Herb. No. 6858 (SAFD). Durban: Inanda, *Wood* 1661 (NH). Camperdown: Hammarsdale, *Forbes* 310 (NH). Empangeni: Utimona, *Gerstner* 2748 (BOL, NH, PRE). Nongoma: Wendelane Kloof, *Gerstner* 4657 (NH, PRE, BOL, NBG). Hlabisa: *Gerstner* 3817 (NH); Hluhluwe Game Reserve, *Ward* 1599. Ngotshe: Ngome Bush, *Gerstner* 2591 (NH, BOL). Ingwavuma: Cecil Mack's Pass, about 8 m. N. of Ingwavuma, *Acoks* 13129 (PRE); *Codd* 2074 (PRE). Without precise locality: "Zululand", *Gerstner* 2820 (BOL).



TRANSVAAL.—Nelspruit: Kruger National Park, Crocodile River Poort, *van der Schijff* 3960 (PRE).

2. *A. dispar* (N.E. Br.) *A. Meeuse*, comb. nov.

*Mimusops dispar* N.E. Br. in Kew Bull. 1895: 107; Engl., Mon. Sapot. Afr. 71 (1904); Wright in Dyer, Fl. Cap. 4, 1: 443 (1906); type: *Thresh* in herb. Wood No. 5425 from Natal, K, lecto., GRA, NH, isos.!

A large shrub or small tree, up to about 10 m. high. *Branches* light grey, terete, usually rather rough and the younger ones marked in stretches with the scars of fallen leaves of a previous generation, but these stretches are not so sharply defined as in *A. sylvestris* (see No. 3); ultimate branches short to very short (unbranched twigs usually less than 10 cm. and often less than 5 cm. long). *Innovations* fulvo-sericeous, but leaves, petioles and twigs soon glabrescent. *Leaves* oblanceolate-cuneate, or oblanceolate-obovate to obovate-oblong, firm but not coriaceous, rather dull and drying green or yellowish-green above, paler and duller beneath, 2–6 (–7) cm. long and 0.75–2 (–2.5) cm. wide, on a 3–8 (–10) mm. long, subterete, widely canaliculate petiole; blade with a very slightly reflexed margin, obtuse, subacute or shortly and bluntly acuminate, but not usually rounded at the top, gradually narrowing into the acute or acuminate-decurrent base; midrib hardly prominent above, rather prominent below; secondary nerves 6–9 on either side, not very distinct from the tertiary ones, ascending at an angle of 45°–60°, rather straight, bifurcate or branched well within the margin and more or less irregularly archingly joining; tertiary nerves mainly parallel to the secondary ones, but branching and anastomosing to form a rather coarse reticulum which is filled up by a very fine areolate nervation, the latter conspicuous on both sides of the leaf. *Flowers* few to many (over 20) on one twig, bracts minute; pedicels rather slender, more or less angular, especially in the slightly thickened part under the calyx, 9–16 mm. long, buffy-brown tomentose. *Sepals* 3 + 3 or 4 + 4; the outer ones ovate-triangular, acute, or subacute, buffy-brown-tomentose outside, with a whitish margin, greyish-tomentose inside near the tip, 5–6 mm. long and about 3 mm. wide; the inner ones about as long and as wide as the outer ones, thinner in texture, ovate-oblong, more obtuse, greyish-pubescent outside with a slightly darker longitudinal streak in the middle and inside at least in the upper half. *Corolla* yellowish, glabrous; the tube very short, about 0.5 mm. long; the lobes and lateral appendages subequal, linear-lanceolate, acute, or subobtuse, 5–6 mm. long and 1–1.5 mm. wide. *Stamens* 6 or 8; filaments 1.5–2 mm. long, subulate from a broad flattened base, the apical part capillary; anthers ovate-lanceolate, acute, 2–3 mm. long, minutely apiculate. *Staminodes* ovate-lanceolate, long-acuminate, concave, hairy at the back, about 3 mm. long. *Ovary* subglobose, densely villous, about 2 mm. in diameter; style glabrous, rather short and comparatively thick, terete, subulate-columnar, 2–3 mm. long, the apex subacute.

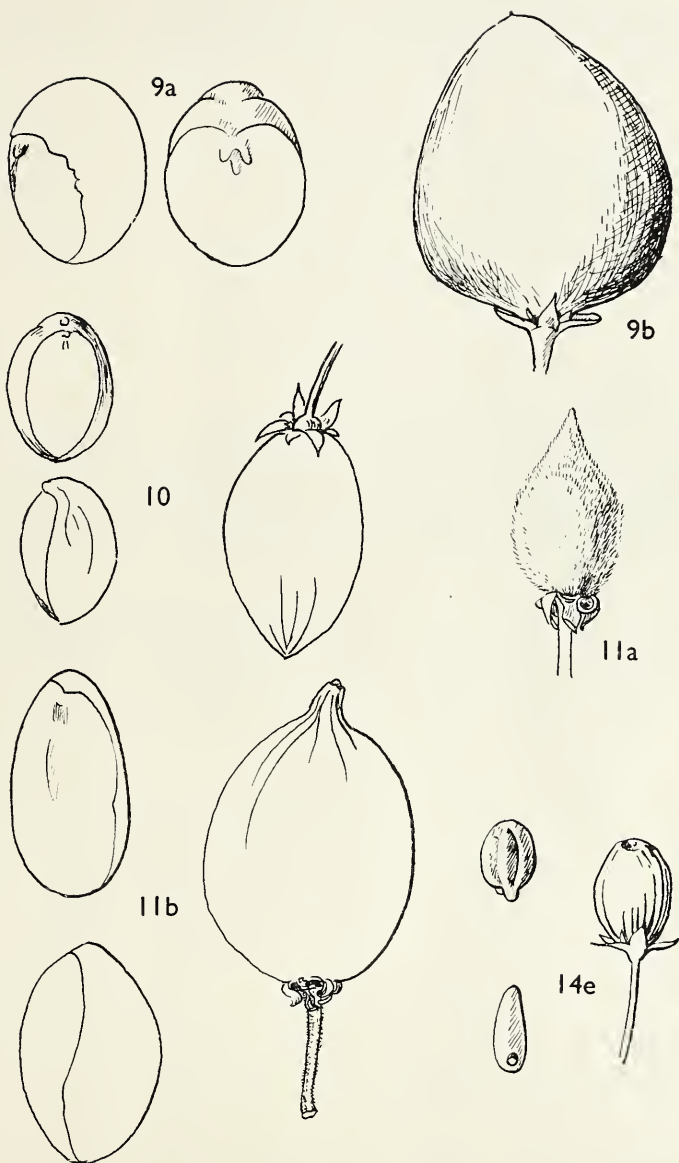
FIG. 9.—*Austromimusops marginata*, seed and fruit (from Pegler 692, Kentani, E. Cape, in BOL).

FIG. 10.—*Austromimusops dispar*, seed and fruit (from Pentz *et al.* "1 A", Weenen Veld Reserve, Natal).

FIG. 11.—*Austromimusops sylvestris*: (a) immature fruit (to show the dense pubescence; from Chase 4328, Umtali, S. Rh.) (b) mature seed and fruit (from seeds sent by Mr. N. C. Chase, coll. in Waranki Reserve, Umtali, S.R.)

*N.B.*—The seed figured was from a large 2-seeded fruit; as a rule the seeds are shorter and comparatively thicker.





*Fruit* green or yellowish-green, ellipsoid or ovoid, apiculate, more or less densely covered with a short brown pubescence, 2–3 cm. long, 1·5–2 (–2·5) cm. in diam.; pericarp thin, almost leathery when fresh, 1- or rarely 2-seeded. *Seed* pale brown, 2–2·5 cm. long and 1·5–2 cm. in diam. with pale whitish scar.

NATAL.—“Thorns” nr. Greytown, *Thresh* in herb. Wood 5425 = NH No. 7175 (NH, GRA, isos!). Estcourt: Mooi Rivier, “Thorns”, Wood 4472 (NH); Sim 2187, 2188 (NU). “Upper Tugela River:” Gerrard (and McKen) 1482 (NH). Weenen: Weenen Veld Reserve, *Acocks* 10148 (PRE, NH), *Pentz* & *Acocks* = *Acocks* 10721 (PRE, NH), *Pentz* 116, 596; “1” (Coll. in 1952), “2” (coll. in 1952). “1A” and “1B” (coll. in 1953 from same trees as “1” and “2” respectively); all in PRE, the last three fruiting specimens); West 1189, 1190 (PRE); Mudén, Sim 19078, 19138 (PRE), *Verdoorn* 1727 (PRE). Msinga: Confluence of Mooi and Tugela Rivers, Ngobevu, *Edwards* 881 (NU, PRE). Umvoti: Keats Drift, *Edwards* 916 (NU, PRE).

3. *A. sylvestris* (*S. Moore*) *A. Meeuse*, comb. nov.

*Mimusops sylvestris* S. Moore in J. Linn. Soc. (Bot.) 40: 132 (1911); type: Swynnerton 570 from Southern Rhodesia in BM, holo.

A shrub or small tree, up to about 7 m. high, with smooth bole. *Branches* terete, greyish, with longitudinal shallow grooves and with slightly thicker stretches marked with rough transverse leaf-scars, especially towards the tips of the twigs below the leaves; ultimate branches rather short (5–15 cm. long) and rather stout (more than 2 mm. thick, sometimes much thicker and up to 6 mm. in diam.), usually with a thicker scarred area just below the leaves. *Buds*, *young leaves* and *young twigs*, *pedicels* and *bracts* densely rusty-tomentose. *Leaves* obovate or obovate-oblong, sometimes oblong or oblong-cuneate, 2·5–6 (–7·5) cm. long and 1·5–3·5 (–4·5) cm. wide, on a rather stout, terete, rather widely canalliculate, rusty-pubescent but ultimately glabrescent, 2–6 mm. long petiole; blade with revolute margin, an obtuse, rounded, emarginate, or more or less retuse, rarely very shortly and bluntly acuminate apex and a narrowed, usually acute but sometimes rounded base, rather firm but not coriaceous in texture, ultimately glabrous and green but not smooth or shiny above, glabrescent but not soon quite glabrous, paler and duller below, midrib usually keeled, sometimes immersed above, rather prominent beneath and keeping vestiges of the original rusty pubescence for a long time; secondary nerves (5–) 7–10 (–12) on either side, as a rule very distinct below, immersed above, rather straight, making an angle of about 60° with the midrib, usually bifurcate well within the margin and more or irregularly joining, but mostly with one distinct ascending branch; tertiary nerves mainly parallel to the secondary ones, but usually sinuous, branched or more or less reticulate; ultimate reticulate nervation very fine, areolate, in dried leaves usually conspicuous on both sides. *Flowers* 1–3 together; bracts densely rusty-tomentose, ovate, 2 mm. long, deciduous; pedicels usually 1·5–2 cm. long, rather stout, terete, but gradually widening near the apex into the calyx, usually pendulous; in fruit not lengthened but slightly incrassate. *Sepals* 4 + 4 or 5 + 5; the outer ones ovate-lanceolate to oblong-lanceolate, about 7 mm. long and 3–3·5 mm. wide, acuminate or narrowed towards the subobtusely apex, densely rusty-tomentose with a distinct greyish-tomentose margin outside, greyish-tomentose inside at least in the upper half; the inner ones somewhat shorter and narrower, greyish pubescent outside with a darker longitudinal streak and inside at least in the upper half. *Corolla* glabrous; the tube about 1 mm. long; the lobes about 7 mm. long, oblong-lanceolate; the appendages slightly shorter. *Filaments* more or less flattened, rather slender, 1·5 mm. long; anthers oblong, obtuse, apiculate, 3 mm. long. *Staminodes* long-triangular-lanceolate, concave, with acuminate, dissected, 2–3 fid or somewhat fimbriate apex, villous with long sinuous hairs outside, the upper half strongly inflexed. *Ovary* sub-globose, about 2 mm. in diam, densely villous; style glabrous, 6–7 mm. long, terete, tapering towards the apex, somewhat truncate-capitate at the tip. *Fruit*

ovoid-ellipsoid, attenuate-apiculate, 3–4.5 cm. long and 2–3 cm. in diam., when young densely rusty-tomentose, glabrescent and dull brown when mature, 1-seeded or 2-seeded; pericarp not juicy, rather dry and leathery. *Seed* broadly ellipsoid to subglobose (those of 2-seeded fruits ellipsoid, more slender), 20–32 mm. long,  $\pm$  20 mm. in diam.; testa dull, very pale straw-coloured; the scar duller and somewhat lighter in colour (see Fig. 13).

S. RHODESIA.—Umtali: Dora Farm, *Chase* 964, 965, 966, 774 (SRGH, *Chase* 965 also in PRE); Glenshiel Farm, *Chase* 1670 (SRGH); Zimunya Reserve, *Chase* 4238 (SRGH, PRE); Maranki Reserve: *Chase* s.n. (ripe fruits, PRE). Bikita: *Wild* 4393 (PRE, SRGH).

Mr. B. de Winter compared the type, *Swynnerton* 570, with *Chase* 966 (Kew) and informed me that there are some minor differences such as shorter and more hairy petioles, smaller flowers, wrinkled leaves. However, the material I have seen is rather variable and the differences mentioned by Mr. de Winter are well within the range of variation, so that I have no doubt about the specific identity.

Apart from the three species dealt with, there is at least one species in tropical Africa. This species, described as *Mimusops cuneata* Engl., has several characteristics of an *Austromimusops*: leaves congested at the ends of the branchlets, with their largest width above the middle, axillary flowers on pendulous pedicels and laterally attached ovules. Judging by Engler's figure and a specimen named *Mimusops cuneata* (Drummond & Hemsley 4203 from Kenya, Kwale Distr., EA, K, PRE) this is very close to *Austromimusops dispar* (but it is much more glabrous than the latter) and to *A. marginata*, and although the fruits are apparently still unknown. I do not hesitate to refer it to the same genus:

***Austromimusops cuneata* (Engl.) A. Meeuse, comb. nov.**

*Mimusops cuneata* Engl., Pflanzenw. O. Afr., C, 307 (1895), and Mon. Sapot. Afr. 70, t. 23, C (1904); Brenan and Greenway, Checklist Tang. Terr. 2: 565 (1949). Recorded from Tanganyika (West-Usambara) by Engler; also in Kenya.

## 7. MIMUSOPS

L., Gen. Pl. ed. 5: 175 (1754), p.p.; Harvey, Gen. S. Afr. Pl. 224 (1838), A. DC. in DC., Prodr. 8: 202 (1844), p.p.; Bentham et Hook., Gen. Pl. 2: 661 (1876), p.p.; Baker in Oliv., Fl. Trop. Afr. 3: 505 (1877), p.p.; Hartog in J. Bot. 17: 358 (1879), p.p.; Engler in Engl. & Prantl., Naturl. Pflanzenfam., ed. 1, 2, 4: 150 (1899), and in Nachträge (1897) 278, pro parte; Engl., Mon. Sapot. Afr. 50 (1904), p.p.; Pilger in Engl. & Prantl., Nachträge 1897–1904, 288 (1906) p.p.; Wright in Dyer, Fl. Cap. 4, 1: 439 (1906), p.p.; Dubard in Ann. Mus. Col. Marseille 23: 46 (1915), Baehni in Candollea 7: 465 (1938); Lam in Blumea 4: 345–347 (1941); Phillips, Gen. S. Afr. Fl. Pl. ed. 2, 568 (1951), p.p.; Royen in Blumea 6: 594 (1952).

Type species: *Mimusops elengi* L., Sp. Pl. ed. 1: 349 (1753). Linnaeus mentioned two species, *M. elengi* and *M. kauki*. *Mimusops kauki* L. is now generally assumed to be the type species of *Manilkara* Adans. [see discussion by Van Royen in Blumea 7: 406 (1953)], which makes *M. elengi* L. undoubtedly the type species of *Mimusops* L. apart from priority of place.

Trees or shrubs. *Leaves* extipulate, not conspicuously crowded towards the tips of the branches and without sclereids and with a rather lax, not conspicuously parallel or "striate" secondary nervation. *Flowers* axillary, pedicellate, constantly 4-merous., *Calyx* biseriate (4 + 4); the sepals free nearly to the base, often long and narrow.

*Corolla* 8-lobed, each lobe with 2 dorsal appendages; the latter entire or divided (in S. Africa always entire). *Stamens* 8, inserted in the throat of the corolla tube; the anthers usually (in S. Africa always) shorter than the long, more or less lanceolates and apiculate anthers. *Alternipetalous staminodes* 8, entire, or somewhat dentate, lacerate or fimbriate at the apex only, often pubescent at least at the back or along the edges (in S. Africa never glabrous), incurved, and more or less covering the style. *Ovary* 8-loculated; ovules with basal attachment; style rather long and slender, cylindric-subulate to filiform. *Fruit* a 1- to few-seeded berry. *Seeds* with a small, circular and almost basal scar; testa shiny hard and thick; endosperm copious, cotyledons thin, foliaceous.

The genus *Mimusops* as understood by Bentham and Hooker, Hartog, Engler and several others is most heterogeneous and comprises forms with 3-merous and others with 4-merous flowers, species with long and narrow ventral seed-scar and others with circular basal scar, plants with staminodes and others without staminodes, forms with endosperm and others without endosperm, etc. Dubard (1915) excluded many species and referred them to several other genera, the majority to *Manilkara* Adans. The latter genus is now almost universally adopted, cf. Van Royen in *Blumea* 7: 401 (1953), but is should be borne in mind that the large genus *Mimusops sensu* Hartog and Engler does not become more homogeneous if only *Manilkara* is taken out. If, however, *Muricea*, *Austromimusops*, *Baillonella*, *Lecomtedoxa* and perhaps several other smaller genera are also excluded, the remainder of *Mimusops* is a reasonably well defined homogeneous genus. In its limited sense, *Mimusops* L. sensu Dubard, Lam and Van Royen comprises between 30 and 40 species, all occurring in Africa, Madagascar, and the Mascarenes, with the exception of *M. elengi* L., a coastal form which occurs in tropical Asia and the W. Pacific. Three species in Southern Africa:

- Leaves obovate, obovate-cuneate or almost obcordate, always distinctly narrowing towards the base, usually emarginate or retuse, with strongly revolute edges and at least when young, with white sometimes fulvous adpressed, more or less silky pubescence below (very old leaves glabrous). Coastal tree..... 1. *M. caffra*.
- Leaves different, glabrous when old or with "powdery" vestiges of a rusty brown pubescence:
- Petioles under 1 cm. long; leaves usually rather small (mostly under 6 cm. long) and usually drying dark brown; branches and leaves very soon glabrous; flowers about 2 cm. in diameter when fully expanded, very rarely smaller, usually solitary in the axles, sometimes 2 together, usually not numerous on a single branchlet..... 2. *M. obovata*.
- Petioles over 1 cm. long; leaves often over 6 cm. long, innovations and young leaves, as well as tips of young branches densely rusty-pubescent, the tips of the branches often remaining pubescent for a considerable time, flowers up to 1.5 cm. in diam, when fully expanded, often in clusters of more than 2 flowers, often numerous on a single branchlet..... 3. *M. zeyheri*.
1. *M. caffra* E. Mey. ex A. DC., Prodr. 8: 203 (March 1844); Wood, Natal Pl. 1: 36, t. 43 (1898); Engl., Mon. Sapot. Afr. 72, t. 27, Fig. B (1904); Wright in Dyer, Fl. Cap. 4, 1: 441 (1906); Sim, For. Fl. Cape Col. 255, fol. 97 (1907); and For. Fl. Port. E. Afr. 80, pl. 75 (1909); Gerstner in J. S. Afr. Bot. 12: 52, Fig. 7 (1946). *M. caffra* E. Mey. ex Drege, Zwei Pflanzeng. Doc. 155 (1843), nomen tantum; type: *Drege* s.n. from Pondoland in G ex herb. DC, holo, L, iso! *M. revoluta* Hochst. apud Krauss in Flora 27: 825 (Dec. 1844); type: *Krauss* 76 from Durban in ?, holo, K iso .

A small tree or large shrub, forming a large proportion of the vegetation on the sand dunes, growing down to the high-water mark and fully exposed to sea winds and spray; exposed specimens usually dwarfed and gnarled, but in sheltered places growing up to about 10 m. high and over 50 cm. stem diameter. *Branches* terete, usually rather stout (about 3 mm. thick), densely leafy towards the tips. *Innovations* densely rusty-tomentose. *Leaves* obovate, obovate-oblong or obovate-cuneate to almost obcordate,



3–6 (–7) cm. long and 1·5–3 (–4) cm. wide; blade firmly coriaceous usually with strongly reflexed margin, glaucous and glabrous above, paler and adpressed silky-pubescent beneath (almost invariably white or silvery), with usually rounded emarginate to retuse apex, tapering into the 5–10 (–15) mm. long petiole; midrib usually a little prominent above in the lower half of the leaf, or flush, rarely somewhat immersed, prominent beneath at least in the lower half; secondary nerves almost straight, slightly prominent on both sides, forming an angle of 30°–50° with the midrib, joining a conspicuous, sinuous intramarginal vein; tertiary nerves and finer nervation hardly more slender than the secondary nerves, and mainly parallel to the latter. *Petioles* terete, slightly thickened towards the base, narrowly but rather deeply channelled above, ultimately glabrous, 5–10 (–15) mm. long. *Flowers* usually numerous on one branchlet, often 2–4 together in the leaf axils. *Pedicels* usually recurved, 2–3 cm. long, mostly distinctly 4-angled, shortly rusty-tomentose (this pubescence tending to become grey later), more or less gradually widening into the calyx. *Flower-buds* about 12 mm. long just before opening. *Sepals* lanceolate, acuminate, about 1 cm. long; the outer ones rusty-tomentose outside, about 3 mm. wide, the inner ones with pale tomentum, about 2 mm. wide. *Corolla* about as long as the calyx, glabrous; the tube short, the lobes about 10 mm. long, each with two about 7 mm. long appendages, all segments lanceolate, usually in two rows consisting of an outer row of 16 appendages and an inner row of 8 corolla lobes. *Filaments* about 2·5 mm. long; anthers about 6 mm. with acute apiculum. *Staminodes* triangular-ovate, slightly longer than the filaments, densely pilose outside with long hairs. *Ovary* ovoid, densely pilose, about 2 mm. long; style long-cylindrical, tapering into an acute point, about 11 mm. long. *Fruit* ovoid, 1·5–2 cm. long, 1–1·5 cm. diam., more or less rounded at the top but often contracted into and crowned by the persistent style, red when ripe, edible, usually (always?) 1-seeded; fruiting pedicels hardly lengthened, slightly incrassate, up to 3 cm. long and about 2 mm. thick; calyx-lobes persistent under fruit, adpressed to the fruit, greyish pubescent. *Seed* oval, subcompressed, indistinctly keeled at the ventral side, not produced at the base, 13–17 mm. long, 8–9 mm. wide and 5–7 mm. thick in the middle; testa shining brown.

#### *Selected Citations.*

CAPE PROVINCE.—Bathurst: Kowie and Port Alfred, *Burchell* 3805; *Britten* 2107, *Marloth* 18097; *Burt-Davy* 7856; *Tyson* s.n.; *Story* 2163. East London: *Galpin* 1835, 9285; *Smith* 3817. Komgha: Kei Mouth, *West* 2024. Kentani: *Pegler* 1298. Elliotdale: *O. B. Miller* FD herb. No. 5591 (SAFD). Port St. Johns: *Schönland* 4038, *Mogg* 770 (= photo of tree, PRE); *Howlet* 44.

CAPE PROVINCE or NATAL.—Bizana or Port Shepstone: “between Umtentu and Umsamkulu”, *Drege* (L, isotype).

NATAL.—Port Shepstone: Margate, *Bayer* 1305 (NU); Port Shepstone, *Mogg* 13197. Umzinto: “South Coast, nr. Botha House”, *Smuts* 2325; *Sezela*, *Smuts* s.n. Pine Town: Winkle Spruit, *Rudatis* 1608; Amanzimtoti, *Kotzé* 453. Durban: near Durban, *Forbes & Obermeyer* 72. Lower Tugela: *Stanger*, *Pentz* 386. Mtunzini: Inyoni bush, *Gerstner* 1936. Hlabisa: St. Lucia Bay, *Lansdell* 31 (NH). Ubombo: near Sordwana Bay, *Gerstner* 733; *Ward* 3013.

PORTUGUESE E. AFRICA.—Sul do Save: Lourenço Marques, *Schlechter* 11986; *Rogers* 21374; *Junod* 134; *Borle* 30; *Pedro* 59; *Gomes e Sousa* 3770; Maputo, *Hornby* 2619; Inhaka Island, *Mogg* s.n.; Chongoene, *Pedro & Pedrogão* 1645. Manica e Sofala: Inhambane, *Earthy* 172 (PRE); *Gomes e Sousa* 1701, 1739, 1908 (COI).

As regards the synonymy, *Mimusops caffra* was the only name used for this species in all recent publications, but *Krauss* in 1844 validly published *Mimusops revoluta* Hochst., based on *Krauss* 76 from Durban. Strangely enough, this name was not

mentioned by Engler (op. cit.) as a synonym of *M. caffra* and is not cited in Fl. Cap., although the number Krauss 76 is quoted in the latter publication. Mr. de Winter kindly supplied the information that an isotype is present in the Kew herbarium and that it is identical with *M. caffra*. Fortunately, the publication of *M. caffra* E. Mey ex A. DC. antedates that of *M. revoluta* Hochst. apud Krauss by several months (mid March 1844 against December 1844) so that the well-known and generally used name *M. caffra* need not be changed.

*M. caffra* is found on coastal sand dunes from Port Alfred (Bathurst) eastwards and northwards to Portuguese E. Africa, also here and there along large rivers more inland on sandy soil.

2. *Mimusops obovata* Sond. in Linnaea 23: 17 (1850); Harvey, Thes. Cap. 1: 28, t. 44 (1859); Engler, Mon. Sapot. Afr. 72, t. 27, Fig. D (1904); Sim, For. Fl. Cape Col. 254, pl. 96 (1907); Wright in Dyer, Fl. Cap. 4, 1: 442 (1906); Marloth, Fl. S. Afr. 3: 36, t. 10 (1932); Gerstner in J. S. Afr. Bot. 12: 54, Fig. 10 (1946); type: Ecklon & Zeyher "Sideroxylon No. 16" from Alexandria, lecto! in S, isos! in GRA, PRE.

*Imbricaria obovata* N. ab. E. ms. ex Sonder, l.c. in syn., Engler, op. cit., 72, in syn.

*Mimusops oleifolia* N.E. Br. in Kew Bull. 1895: 109 Engler, op. cit., 73, t. 34, Fig. B; Wright, op. cit., 442; type: Gerrard 1642 in K, holo., NH, iso! from "Tugela", Natal.

*M. woodii* Engl., op. cit., p. 65, t. 26, Fig. A; Wright, op. p. 440; type: Wood 683 in B, holo†, BOL, NBG, isos! from Inanda, near Durban.

*M. rudatisii* Engl. et Krause in Engl. Bot. Jb. 49 (1913), p. 395; type: Rudatis 1136 in B, holo†, L, PRE, isos! from Dumisa, Natal.

A medium-sized tree, up to 20 m. high and 60 cm. stem diam., according to Sim (in MS.) occurring mainly in rather open mountain forests, but also in coastal areas. *Branchlets* terete, glabrous, rather slender, usually longitudinally wrinkled and light grey, as a rule uniformly leafy. *Innovations* rusty-tomentose, very soon glabrescent, older parts ultimately quite glabrous. *Leaves* variable in size and shape, but usually obovate, obovate-oblong or obovate-cuneate, sometimes more oval or elliptic or obovate-oblancoate, 2-6 (-7) cm. long and 1-3 (-4) cm. wide, rarely narrowly lanceolate, 2.5-6 cm. long and 4-9 mm. wide, more or less thinly coriaceous, usually drying very dark brown and shiny above, pale brown and dull beneath, sometimes drying grey above; the apex obtuse or rarely subacute, sometimes rounded, but mainly in the obovate-cuneate type of leaf) not infrequently with a short, blunt acumen, tapering at the base, which is always acute or subacute, and with minutely reflexed margins; midrib almost flush above, slightly prominent beneath; secondary nerves ascending at an angle of  $\pm 45^\circ$ , rather straight, but very few reaching the leaf margin without branching, joining other veins or slightly deflexing in the points where the tertiary nervations join them, archingly joining near the margin; tertiary veins forming a rather fine distinct reticular nervation which is usually very conspicuous in dried leaves and slightly prominent, at least on the lower surface. *Petioles* comparatively slender, terete, channelled above near the leaf-base, 3-9 mm. long. *Flowers* white, fragrant, solitary or in twos in the leaf axils on 1-3 (usually 1.5-2) cm. long, brownish-tomentose, slender and suberect or patent, usually not distinctly drooping pedicels; flower buds usually  $\pm 1$  cm. long just before opening. *Outer sepals* (6-) 8-12 mm. long and 3-3.5 mm. wide, shortly rusty-tomentose with a very narrow whitish or pale-grey edge, narrowly ovate-lanceolate, acuminate; inner sepals slightly shorter and narrower, with a pale grey or whitish tomentum and minutely ciliate, soon reflexed. *Corolla-tube* short, 1 mm. long; the 8 lobes linear-lanceolate or

narrowly oblong,  $\pm 1$  cm. long, rarely smaller (6–8) mm., the lateral appendages about as long, usually more acute than the lobes. *Filaments* thick, 1–2.5 mm. long, much shorter than the sagittate-oblong, or linear oblong, apiculate, 3–6 mm. long anthers. *Staminodes* long-triangular or lanceolate-subulate from a broad base, villous outside, shorter than the stamens but longer than the filaments. *Ovary* ovoid or oblong-ovoid,  $\pm 2$  mm. high, densely pilose; style glabrous, terete, slender, longer than the corolla and up to  $\pm 12$  mm. long, slightly tapering towards the apex which is truncate and often subcapitellate. *Fruiting pedicels* somewhat incrassate; calyx under fruit persistent, reflexed or ultimately deciduous. *Fruit* ovoid or ovoid-acuminate, 2–3.5 cm. long, 1–2 cm. in diam., often 1-seeded, ultimately glabrous, smooth, orange-red or yellow when ripe. *Seed*, when single, 2–2.5 cm. long, 8–10 wide and 6–8 mm. thick in the centre, oblong, with rounded apex and obliquely truncate-notched base, often distinctly keeled on the side above the small, circular,  $\pm 2$  mm. wide scar, but if more seeds are present in one fruit, often smaller and  $\pm$  irregularly shaped, flattened and less distinctly truncate-notched or keeled; testa brown, shiny.

*General Distribution*.—From the Eastern Cape eastward and northwards into Natal, Swaziland, Zululand, Eastern Transvaal and Portuguese East Africa (possibly extending into tropical East Africa, because several species described from that area appear very similar from the descriptions, but no actual specimens seen) in evergreen forests in frost-free areas, mainly at low to fairly low altitudes.

CAPE PROVINCE.—Alexandria: Olifantshoek, *Ecklon & Zeyher* (S, lecto., PRE, GRA isos); *Zeyher* (PRE), *Ecklon & Zeyher* or *Zeyher* (SAM). Bathurst: *Acocks* 11139 (PRE); Kariega Mouth, *Acocks* 18348 (PRE); Port Alfred, *Britten* 1681 (GRA, PRE). Albany: near Grahamstown, *MacOwan* 258 (GRA, HN, BOL, SAM); *Galpin* 179 (GRA, PRE); Beggar's Bush Forest Reserve, *Archibald* 5966 (PRE); Blaauwkrantz, *Britten* 897 (GRA, PRE); Paradise Kloof, *Story* 3128 (PRE). Stutterheim: *Sim* 2273 (or 21922?; NU); *Acocks* 8939; *Story* 1242. King William's Town: Pirie, *Sim* 1333 (NU); *Ross* s.n. (SAFD No. 1903). East London: *Galpin* 3164 (GRA, PRE), 9518, 10432 (PRE); *Smith* 3783, 3818 (PRE); *Sim* 2189 pp. (NU). Komgha: *Flanagan* 249 (PRE, BOL, SAM). Kentani: *Pegler* 765 (PRE, BOL, GRA, NBG); Qolora, *Edward* in h. Moss 17544 (J). Engcobo: Manina, *Zahn* 22, v.d. Merwe FD No. 2200 (SAFD). Ngqeleni: Qokama, *Acocks* 13426 (PRE). Port St. Johns: near Port St. Johns, *Moss* 4686 (J); *Boshoff* FD No. 5032 (SAFD). "Pondoland": Egossa and Port St. Johns, *Sim* 2418 (NU, PRE). Lusikisiki: *Acocks* 13426 (PRE), Miller FD No. 5771 (SAFD). Flagstaff: *R. C. Coloured School* s.n. (GRA).

NATAL.—Port Shepstone: "South Coast Natal", *Pole Evans* 761 (PRE); South-broom, *Codd* 9705 (PRE). Umzinto: Dumisa, *Rudatis* 1136 (L, PRE, isos of *M. rudatisii* Engl. et Krause). Umlazi: Park Rhynie, "Indian collector" s.n. (NH No. 14819); Winkle Spruit, *Van der Bijl* s.n. (NH No. 16136). Durban: Isipingo, *Ward* 342 (NU), 503 (NU, PRE); near Durban, *Wood* 5797 (BOL), 9112 (PRE); *Gerrard & McKen* 720, 869 (NH); *Rogers* 24502 (PRE); *Stayner* 20 (BOL); *Wylie* s.n. (= 23114, also PRE); Inanda, *Wood* 683 (BOL, NBG, isos of *M. woodii* Engl.); Umgeni Dam, *Bayer* 1387 (NU, NH, PRE, BOL). Pine Town: Marian Hill, *Forbes* 1039 (NH). Verulam: Umhloti Beach, *Codd* 1499 (PRE). Kranskop: Jameson's Drift, *Bayer* 540 (NU). Msinga: Nogbeva, *Edwards* 878 (PRE, NU). Nkandla: Middeldrift, *Edwards* 1423, 1424 (PRE, NU). Eshowe: Lawn 666 (NH); *Gerstner* 1922 (PRE), 2262, 2440 (NH, PRE), 2819 (BOL), 2994 (NH); Entumeni Waterfall, *Wylie* s.n. p.p. (NH No. 12940, the remainder is *M. caffra*). "Tugela": *Gerrard* 1642 (= iso. of *oleifolia* N. E. Br., NH). Mtunzini: near Mandeni, *Edwards* 1616 (PRE, NU). Lower Umfolozi: Umfolozi Game Reserve, *Ward* 3159 (PRE); *Kluge* 19 (NH); *Mtonjaneni*: *Gerstner* 3675 (NH, PRE); Empangeni, *Gerstner* 2767 (NH), 2730 (NH, BOL, PRE). Hlabisa: Hluhluwe, *Ward* 1700 (PRE); Masimba Hill, *West* 2078 (NH, PRE); Hlabisa



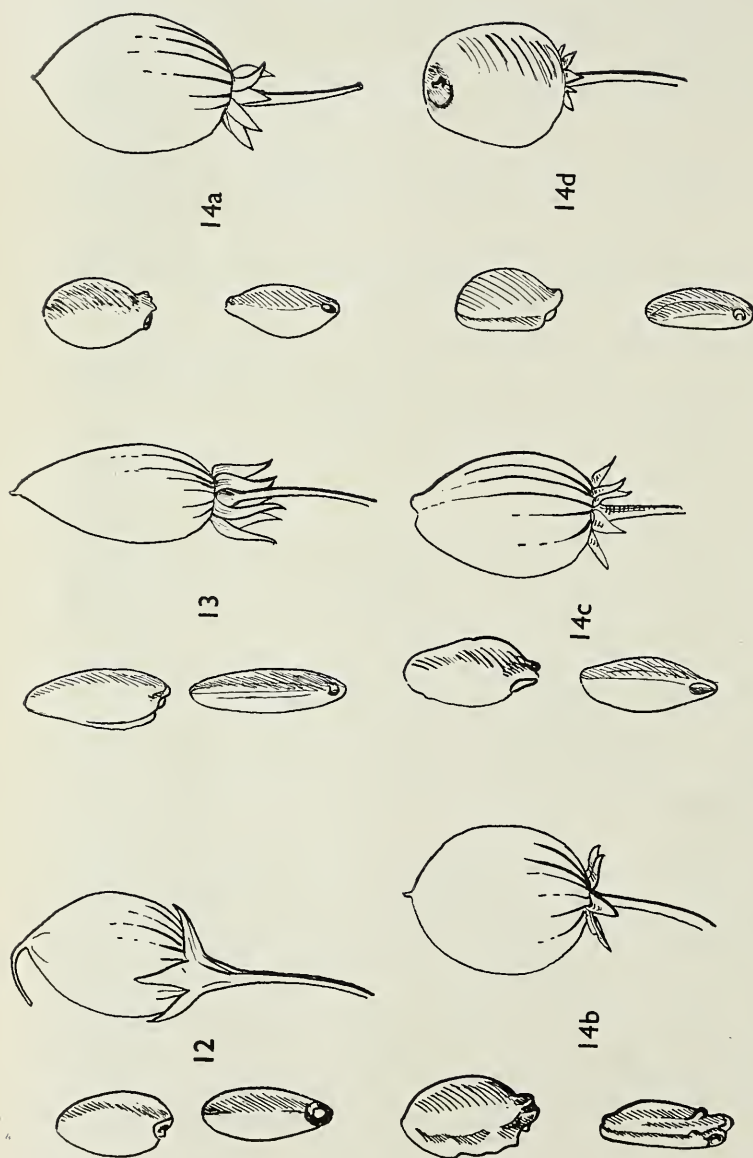


FIG. 12.—*Minusops affra*, seed and fruit (from Howlett 44, Kentani, E. Cape).

FIG. 13.—*Minusops obovata*, seed and fruit (from a 1-seeded fruit of Pegler 765, Kentani, E. Cape). N.B.—Seeds of fruits with 2 or more seeds are often smaller and more or less deformed.

FIG. 14.—*Minusops zeyheri*, seeds and fruits: (a) from Codd 3023 (Zoutpansberg, Transvaal), (b) from Smuts & Gillett 3286 (Zoutpansberg), (c) from Lam & Meeuse 4824 (Buffelspoortdam, nr. Pretoria, not far from the type locality!), (d) from a specimen without collector or locality, named *M. kirkii* in PRE, (e), figure on p. 353, from O. B. Miller B/220 (Molepolole, Bechuanaland Prot.). Note the variation in size and shape of fruits and seeds.



or Umbombo: near northern end of St. Lucia Lake, *Gerstner* 4987 (PRE). Nongoma: Wendelane Kloof, *Gerstner* 4659 (PRE, NBG). Ngwavuma: *Bayer* 760 (PRE). Natal without precise locality: *Gueinzuis* (original syntype gathering, presumably from the vicinity of Durban, in SAM); *Cooper* 1241 (BOL, NH, PRE).

SWAZILAND.—*Stewart* s.n. (TRV No. 8824 in GRA, PRE); Ubombo Mts. near Stegi, *Keith* s.n. (PRE).

TRANSVAAL.—Sebasa: Phephidi River (prob. near Phephidi Falls), *Legat* 1 (SAFD). Letaba: Patatabos, *Botha* s.n. = FD. No. 7154 (SAFD, PRE); The Downs, *Renny* DB 52 (PRE); De Hoek, *Keet* FD No. 7413 (SAFD).

PORTUGUESE EAST AFRICA.—Sul do Save: Lourenço Marques, *Gomes e Sousa* 3859 (COI, PRE).

*N.B.*—The specimen mentioned in Fl. Cap. 4, 1: 442 from Warmbaths, Transvaal (*Burt Davy* 2625) is not *M. obovata* Sond., but *M. zeyheri* Sond.

The shape of the leaves of one specimen is usually fairly uniform but the various forms described as *M. oleifolia* N.E. Br., *M. woodii* Engl. and *M. rudatisii* Engl. & Krause, are, in my opinion, only ecotypes, as was already suggested by Gerstner. The forest form has rather thin leaves which are large and obovate, and corresponds with the descriptions of *M. obovata* and of *M. woodii*; a depauperate form growing in rocky places in the sun, has small coriaceous leaves, flowers more freely and corresponds with the narrow-leaved *M. oleifolia*. Not only are all these forms linked up in the herbarium by intermediate specimens, but the flowers, branches, pedicels, fruits and seeds are also identical.

A type specimen was not defined, because Sonder mentions the numbers *Gueinzuis* 583 and 101 ex parte from Durban, and Ecklon & Zeyher's "Sideroxylon No. 16" from Olifantshoek. The *Ecklon & Zeyher* collection being the best known and better represented in various herbaria, I propose the E. & Z. specimen in herb. Sonder (S) as the lectotype.

3. *M. zeyheri* Sond. in *Linnaea* 23: 44 (1850); Engl., *Mon. Sapot. Afr.* 73, t. 27, Fig. C (1904), incl. var. *laurifolia* Engl.; Wright in Dyer, Fl. Cap. 4, 1: 441 (1906); Gerstner in J. S. Afr. Bot. 12: 54 (1946); Meeuse in R. A. Dyer, Fl. Pl. Afr. 30: t. 1164 (1954), type: *Zeyher* 1130 in herb. Sonder, holo., BOL, NBG, isos.! *M. kirkii* Baker in Oliv., Fl. Trop. Afr. 3: 567 (1877); Engl., op. cit. 67; Gerstner, op. cit., 55, type: *Kirk* s.n. from Lower Shire Valley and *Kirk* s.n. from Rovuma in K, syns. *M. monroi* Sp. Moore in J. Bot. 49: 55 (1911); type: *Monro* 761 in BM, holo.; BOL, SRGH, isos!

A tree reaching a height of at least 10–15 m., with spreading branches and a leafy, umbrageous canopy, but often appearing as a large shrub. *Innovations* densely adpressed rusty-tomentose, the twigs often retaining the pubescence for some time, the leaves sometimes in the form or irregular, powdery patches or along the midrib; branches, petioles and leaves ultimately glabrous. *Leaves* coriaceous or thinly coriaceous, shiny above, paler beneath, usually drying a pale greyish-green (young ones drying dark brown above, brownish-grey beneath), ovate-lanceolate to oblong-ovate, sometimes obovate or broadly elliptic, sometimes broadly lanceolate, usually obtusely acuminate or gradually tapering into the obtuse or more rarely slightly emarginate, occasionally rounded apex, tapering, acute or subacute at the base, with slightly thickened and subreflexed margin, 4–9 (–11) cm. long (on coppice shoots occasionally up to 15 cm. long) and 2–4 (–5) cm. wide, on a (10–) 15–35 mm. long, terete, petiole which is rather firm, narrowly canaliculate at least near the leaf-base and not infrequently shows vestiges of the original reddish-brown tomentum; midrib forming a fine keel above, prominent below, very gradually tapering towards the apex of the leaf; lateral

nerves ascending at an angle of  $45^{\circ}$ – $60^{\circ}$ , usually not reaching the margin without branching, joining or deflexing, archingly joining near the edge of the leaf, not or hardly distinct from the tertiary nerves, the latter first more or less parallel to secondary ones, then becoming irregular, forming a rather coarse reticulate meshwork filled up by a finer reticulate nervation; secondary and tertiary nerves usually conspicuous, slightly raised, finer nervation often inconspicuous. *Pedicels* often numerous on the twigs in fascicles of 3 or more in the leaf axils, sometimes only 1–3 per axil, 10–30 mm. (but almost invariably between 15 and 25 mm.) long, rusty-pubescent, recurved, not lengthening but slightly incrassate (up to  $\pm 1.5$  mm. thick) in fruit. *Flower-buds* just before opening 5–7 mm. long and 3–4 mm. thick. *Sepals* long-triangular to ovate-lanceolate, acute; the outer ones rusty-pubescent often with a narrow pale edge, 5–6 (–7) mm. long and 2–3 mm. wide, the inner ones pale greyish-white tomentose, slightly shorter and narrower. *Corolla*-lobes about equalling the calyx, about 6 mm. long, linear-lanceolate, acute, their appendages about or long as shorter (4–6 mm.), linear-lanceolate and acute. *Anthers* elongate-sagittate, apiculate, about 3.5 mm. long on subulate, 1.5 mm. long filaments. *Staminodes* long-triangular or triangular-lanceolate, either shorter than the stamens and acute, or longer than the stamens and long-acuminate to nearly aristate, densely pilose outside. *Ovary* globose or ovoid, about 2.5 mm. long, villous, attenuated into a 5–10 mm. long style, the latter glabrous, terete, longsubulate, tapering towards the apex. *Fruiting calyx* not accrescent, somewhat spreading but not quite reflexed as a rule. *Berry* ovoid, ellipsoid or almost spherical, 2–3 cm. long, 1.2–1.5 cm. diam, sometimes smaller, glabrous and yellow when ripe, usually crowned by the persistent style (at least when young), with mealy, edible pulp, 1–4 seeded. *Seeds* obovate or elliptic, compressed, usually 15–20 mm. long, 9–12 mm. wide and 4–5 mm. thick, sometimes considerably smaller; often (especially when only 1 or 2 seeds are present) more or less laterally produced or at any rate somewhat attenuated at the base; the scar nearly basal, almost horizontal, in a hollow sinus; testa light brown, shiny.

*General Distribution*.—Bechuanaland, Transvaal, Swaziland, Portuguese East Africa, Rhodesia and extending into tropical East Africa.

BECHUANALAND.—Gaberones, *Van Son* s.n.; Kanye, *O. B. Miller* B/298; Lobatsi Govt. Farm, *O. B. Miller* B/245 (PRE); Molepolole, *O. B. Miller* B/220 (PRE); Chobe Riv. nr. Serondela, *O. B. Miller* B/337 (PRE).

TRANSSAAL.—Marico: *Louw* 610; Zeerust, *Thode* A1438. Rustenburg: Rustenburg, *Sutton* 885, 885a, 1023; *Phillips* s.n.; *Phillips & Schweickerdt* 3550; *Rose-Innes* 1 (PRE); Pretoria, Brits and Magaliesberg Range: *Zeyher* 1130 (BOL, SAM, isos!); *Burke* 72 (PRE, SAM, for practical purposes duplicates of *Zeyher* 1130); *Leendertz* s.n. 949; *Galpin* 6975; *Lam & Meense* 4824 (L); *Meeuse* 9095, 9095a; *Hutchinson & Mogg* 2905. Johannesburg: Modderfontein, *Putterill* 161. Middelburg: Olifants Riv. Gorge, *Mogg* 22447. Warmbaths: Warmbaths, *Burt-Davy* 2149, 2625; *Galpin* 8853. Waterberg: Nylstroom, *Prosser* 1753, Rietspruit, 40 miles NNW of Vaalwater, *Smuts* 362. Potgietersrust: *Galpin* 8823, 9023; *Smuts* 2006, Pietersburg: Blaauwberg, Leipzig, *Bremekamp & Schweickerdt* 1118; Daviesville, Setali, *Gerstner* 5429; Woodbush, *Hoffmann* 30; De Hoek Forest Reserve, *Keet* h. No. FD 7413. Zoutpansberg: near Louis Trichardt, *Obermeyer*, *Schweickerdt* & *Verdoorn* 361a; *Hutchinson* 2004; *Rodin* 3987; *Rogers* 2177; Hanglip, *Gerstner* 5994; 20 miles NW of Louis Trichardt, *Codd* 3023; Happy Rest, *Gerstner* 6031; 10 miles E. of L. Trichardt, *Gerstner* 5731; Tshakoma, *Obermeyer* 1092;  $\pm$  10 m. W. of Wyllie's Poort, *Gerstner*

5923 (PRE). Sebasa: Phepidi Falls, *Smuts & Gillett* 3308, 3286; *Curson & Irvine* 55, 109; *Legat* 4819; Kruger National Park, near Pafuri, v. d. *Schijff* 578, 3812; id., Punda Maria, *Lang* s.n.; *Codd* 6514; v. d. *Schijff & Marais* 3728. Letaba: Duiwelskloof, *Gerstner* 5881. Lydenburg: Sekukuniland, *van Warmelo* 94; *Mogg* 16916 (PRE); *Barnard & Mogg* 762; *Barnard* 13 (PRE). Pilgrims Rest: Mariepskop, *Scheffler* FD herb. No. 9946 (SAFD); Lothian, FD herb. No. 890 (SAFD). Nelspruit: Kruger National Park, Numbi: *van der Schijff* 25; 'near Sabin, *Codd* 4409 *van der Schijff* 696, 1461 Barberton: *Thorncroft* 2177; *Liebenberg* 2630; *Burt-Davy* 2810.

SWAZILAND.—Lebombo Mts., *Hornby* 2805; Stegi, *Codd & Dyer* 2910, *O. B. Miller* S/76; *Acocks* 15350.

PORTUGUESE E. AFRICA.—Sul do Save: Guíja, *Myre & Balsinhas* 788 (PRE); *Pedrogão* 262 (PRE); *Pedro & Pedrogão* 2974 (PRE) Chegua, Chongoene, *Gomes e Sousa* 3999 (PRE); Matola, Imputa River, *Mogg* s.n. (PRE); Macovane, *Hornby* 2714 (SRGH, PRE). Manica e Sofala: Serra da Gorongoza, *Simão* 952 (PRE); “á milha 25 da T.Z.R.”, *Simão* 818 (PRE); Lifumba (Mutarara), *Simão* 1488 (LM). Zambezia: Mocuba, Namagoa, *Faulkner* 56 (PRE, COI); betw. Régulo Ingive and Nante, *Barbosa & Carvalho* 4203 (PRE). Niassa: Pto. Amelia, btw. Mocimboa da Praia and Palma, *Barbosa* 2122 (PRE).

S. RHODESIA.—Bulalima—Mangwe: Plumtree, *Davies* 280 (SRGH); Mangwe, Marula, *Plowes* 1309 (SRGH, PRE). Bulawayo: Matopos, *O. B. Miller* B/1257 (PRE), *Mundy* 892, 904, 909 (SRGH); *Plowes* 1331 (SRGH, PRE); *West* 2941 (SRGH); *Orpen* 049/50 (SRGH); *Borle* 45 (PRE); *West* 2494 (SRGH). Belingwe: *Harvie* 9/51 (SRGH); 9/51 (SRGH); *West* 2792 (SRGH); Nuanetsi: Matibi I Reserve, *Davies* 1773 (SRGH, PRE); Ft. Victoria: *Eyles* (?) in SRGH No. 3863; N.N. 52/51 in SRGH No. 34663; *McGregor* 2/47 (SRGH); *Acheson* 13 (SRGH); *Monro* 690 BOL); 761 (SRGH, BOL isos of *Mimusops monroi* Sp. Moore); Zimbabwe, *Hornby* 2831 (PRE); *Smuts* s.n. (PRE); *Gerstner* 6987 (PRE); *Seward* 47/51 (SRGH); *Seymour-Hall* 3/51 (SRGH) Chilimanzi: *Wormold* 21/51 (SRGH); *Mylne* 1/51 (SRGH); *Kirkham* 18/51 (SRGH); *Gibson* 5/51 (SRGH); *Greenhow* 24/51 (SRGH, PRE). Sabi-Lundi: *Wild* 3353, 3377 (SRGH, PRE). Ndanga: *Chase* 2338 (SRGH, PRE), 2416 (SRGH). Gwelo: *Eyles* 5555 (SRGH); leg. *Eyles* (?) (SRGH No. 3331); *Steedman* 210 (SRGH). Hartley: *Hornby* 3230 (SRGH); *Jack* s.n. (SRGH No. 4082); Umniati Riv., *Mills* 5/47 (SRGH). Umtali: *Obermeyer* 2070 (PRE); *Chase* 317, 1314, 1531 (SRGH), 869 (SRGH, PRE). “Eastern Border”: *Chorley* s.n. (SRGH No. 3685). Vumba Mts.: *Chase* 1741 (SRGH). Salisbury: Concession, *Eyles*? in SRGH No. 1124. Mazoe: *Eyles* 4773 (SRGH); *Mundy* s.n. (SRGH No. 2090); *Ford* s.n. (SRGH No. 5146). Lomagundi: *Eyles* 2689, 2715 (SRGH, PRE, SAM), 3130 (SAM, PRE) 4971, 4973 (SRGH) *Pardy* s.n. (SRGH Nos. 5918, 5924). “Zambesi”: *West* 2900 (SRGH). Urungwe: *Lovemore* 291, 361 (SRGH, PRE). Victoria Falls: *Flanagan* 3302 (BOL); *Galpin* 7044 (GRA, PRE, BOL), 14999 (PRE); *Rogers* 5310 (GRA, BOL, SAM); 7446 (J); *Schwartz* s.n. (BOL 25012); *Rodin* 4492 (PRE, SRGH); *Wild* 3130 (SRGH); *Greenway* 6250 (PRE), *Poynton* 12 = FD herb. No. 10403 (SAFD).

NORTHERN RHODESIA.—Nega-Nega Hills: *Burt Davy* 762 (PRE).

NYASALAND.—Likubula Gorge: *Brass* 16366 (= Vernay Nyasaland Exp. 1946) (PRE).



As regards the identity of *M. zeyheri* Sond and *M. kirkii* Baker the following "differences" can be found in the original descriptions (see also Engler, op. cit.):

	<i>M. zeyheri</i> .	<i>M. kirkii</i> .
Pubescence:	Young parts rusty-tomentose. Blade	Twigs nearly glabrous. Blade coriaceous,
Leaf:	coriaceous, ultimately glabrous, oblong, obtusely acuminate, more or less narrowed at the base with distinct lateral veins, $7\frac{1}{2}$ –9 cm. long, $2\frac{1}{2}$ – $3\frac{1}{2}$ cm. wide, on a 16–20 mm. long petiole.	glabrous, obovate-oblong, obtuse, cuneate at the base, with fine main veins, 5–10 cm. long, $3\frac{1}{2}$ –4 cm. wide on a 15–25 mm. long petiole.
Flowers:	Pedicels in fascicles of 3 or more, 12–18 mm. long, recurved, staminodes shorter than the stamens; (according to Engler's key): lateral appendages shorter than corolla-lobes; style short.	Few together, on 12–20 mm. long arching pedicels; staminodes about as long as the stamens (according to Engler's key); lateral appendages about as long as corolla-lobes; "style much exerted from the corolla".
Fruit:	Ellipsoid, glabrous, an inch long, seed obovate, compressed, subproduced at the base.	Globose, glabrous, an inch long; seed?

These differences appear to be very slight, and the most important ones seem to be the length of the lateral appendages, the length of the style and the shape of the fruit. However, subequal corolla-lobes and appendages can be found occurring with short staminodes and with longer ones, with short styles and with longer ones. The fruits in *M. zeyheri* vary from globose to ovoid and the seeds of fruiting specimens referred to *M. kirkii* (including the fruiting type specimen) in various herbaria show the characteristic produced base reported for *M. zeyheri*. Mr. B. de Winter compared specimens of *Mimusops* from the Transvaal with the type of *M. kirkii* and with authentic specimens of *M. zeyheri* at Kew and some of them correspond with either form, but there are intermediate specimens which link them up. The Rhodesian material I saw shows a complete continuous transition from the narrow leaved forms (= *M. zeyheri*) to the broad-leaved forms (= *M. kirkii*), and the rusty pubescence of the innovations occurs in both forms. In my opinion the form which corresponds with *M. zeyheri* is the Bushveld ecotype and often shrubby, whereas the broad-leaved form is a Lowveld ecotype (more tropical hence large trees), but there is no question about their specific identity.

*Mimusops monroi* S. Moore is a narrow-leaved form of "typical" *M. zeyheri*. Mr. de Winter kindly compared the type of *M. monroi* (Monro 761 in BM) and reported that it is an almost perfect match of *Burke* 72 from the Magaliesberg (in herb. Kew), which number is a "twin-type", practically identical with *Zeyher* 1130, the type of *M. zeyheri*, so that there is no doubt about the conspecificity of both species. Duplicates of *Monro* 761 in BOL and SRGH which I have seen are indistinguishable from most Transvaal specimens and certainly conspecific.

#### EXCLUDED SPECIES OF MIMUSOPS.

*Mimusops altissima* Engl. = *Muriea* spec. [an *Muriea discolor* (Sond.) Hartog?], see p. 379.

*M. angolensis* Engl. = *Manilkara cuneifolia* (Baker) Dubard (a duplicate of the type, *Wehwitsch* 4836 in COI, was studied).

*M. buchananii* Engl. = *Muriea* spec. (an *M. discolor*?, see p. 379).

*M. concolor* Harv. ex Wright = *Manilkara concolor* (Harv. ex Wright) Gerstner.



- M. cuneata* Engl. = *Austromimusops cuneata* (Engl.) A. Meeuse, see p. 355.
- M. cuneifolia* Baker = *Manilkara cuneifolia* (Baker) Dubard.
- M. densiflora* Baker = *Manilkara multinervis* (Baker) Dubard (t. Engler and Hutch. & Dalz.)
- M. densiflora* Engl. non Baker = *Manilkara moehria* (Baker) Dubard, see p. 369.
- M. discolor* (Sond) Hartog = *Muriera discolor* (Sond.) Hartog, see p. 344.
- M. dispar* N.E. Br. = *Austromimusops dispar* (N.E. Br.) A. Meeuse, see p. 352.
- M. fischeri* Engl. = *Manilkara spec.*, prob. *M. moehria* (Baker) Dubard.
- M. henriquesiana* Sim = *Lecomtedoxa henriquesii* (Engl. et Warb.) A. Meeuse, see p. 344.
- M. henriquesii* Engl. et Warb. = *Lecomtedoxa henriquesii*.
- M. klaineana* (Pierre ex) Engl. = *Lecomtedoxa klaineana* (Engl.) Dubard.
- M. macaulayae* Hutch. et Corb. = *Manilkara macaulayae* (Hutch. et Corb.) H. J. Lam, see p. 373.
- M. marginata* N.E. Br. = *Austromimusops marginata* (N.E. Br.) A. Meeuse, see p. 348.
- M. menyhartii* Engl. = *Manilkara moehria* (Bak.) Dubard, see p. 369.
- M. moehria* Baker = *Manilkara moehria* (Bak.) Dubard.
- M. natalensis* (Pierre) Engl. non *M. natalensis* Schinz = *Muriera discolor*, see p. 377.
- M. natalensis* Schinz = *Austromimusops marginata* (N.E. Br.) A. Meeuse.
- M. schinzii* Engl. = *Austromimusops marginata* (N.E. Br.) A. Meeuse.
- M. spiculosa* Hutch. et Corb. = *Manilkara macaulayae* (Hutch. et Corb.) H. J. Lam.
- M. silvestris* S. Moore = *Austromimusops silvestris* (S. Moore) A. Meeuse, see p. 354.
- “*M. transvaalensis* Schinz” (sphalm.) ex Radlk. (recte: *natalensis*) = *Austromimusops marginata* (N.E. Br.) A. Meeuse.
- M. umbraculigera* Hutch. et Corb. = *Manilkara macaulayae* (Hutch. et Corb.) H. J. Lam.
- M. welwitschii* Engl. = *Manilkara cuneifolia* (Baker) Dubard.
- M. zanzibarensis* Engl. = *Manilkara zanzibarensis* (Engl.) Dubard.

## 8. MANILKARA.

- Adans. emend.* Gilly in Trop. Woods 73: 1-22 (1943); Lam & Royen in Taxon. 2, 5: 112 (1953); Royen in Blumea 7: 401 (1953), nomen conserv. propos.
- Manilkara* Adans., Fam. Pl. 2: 166 (1763); Dubard in Ann. Mus. Col. Marseille 23: 6 (1915); Baehni in Candollea 7: 462 (1938); Lam in Blumea 4: 323 (1941).
- Mimusops* pro parte, A.DC. in DC., Prodr. 8: 203 (1844) (quoad sect. *Ternaria* ADC.); Bentham & Hook., Gen. Pl. 2: 661 (1876); Baker in Oliv., Fl. Trop. Afr. 3: 505 (1877); Engl., Mon. Sapot. Afr. 55 (1904) (quoad section *Euternaria* Engl. exclus. *Muriera*); Wright in Dyer, Fl. Cap. 4, 1: 439, 1906; Phillips, Gen. S. Afr. Fl. Pl. ed. 2, 568 (1951).

Trees or large shrubs. *Stipules* caducous or none. *Leaves* usually crowded at the tips of the branches; often more or less oblong-obovate with rounded (and emarginate) apex; lower side often lighter than upper one, mesophyll with sclereids; the nervation is usually parallel (tertiary nerves parallel to secondary ones), often causing a striate appearance of the leaf. *Flowers* axillary, usually in the axils of the lower leaves of the branches or of the scars of fallen leaves, 3-merous or occasionally 4-merous. *Sepals* biseriate, 3 + 3 (or 4 + 4), often rather broad. *Corolla* 6- (or 8)-lobed, each lobe (in the South African species) with two dorsal appendages. *Stamens* 6 (or 8), inserted in the throat of the corolla tube; filaments usually longer than the rather small anthers. *Alternipetalous staminodes* 6 (or 8), or sometimes fewer than the number of stamens, but never absent, usually small, often more or less dentate, lobed, firm-briate or divided, glabrous; not incurved and not covering the style as in *Mimusops*, but erect with the stamens of reflexed with the corolla. *Ovary* 6- (or 8)-loculated, sometimes up to 15-loculated; ovules ventrally or basiventrally attached. *Berry* one- to several-seeded. *Seeds* more or less laterally compressed; testa crustaceous, brittle, or hard and bony; scar ventral, long and narrow, or basiventral and rather large and wide, rarely small, basal; endosperm copious, cotyledons thin, foliaceous.

Type species: *Mimusops kauki* L., Sp. Pl. ed. 1, 349 (1753) = *Manilkara kauki* (L.) Dub. in Ann Mus. Col. Marseille 23: 9 (1915), fide Van Royen in Blumea 7: 402.

*Distribution*.—Circumtropical; about 25 species in tropical America, about 30 in tropical Africa, South Africa and the Mascarenes and about 15 in the Far East and Pacific islands.

*Manilkara* is now almost universally recognised as a distinct genus. For a detailed discussion of the differences between this genus and *Mimusops*, cf. Lam., op. cit., 345-347. For the area under discussion, the main differences are given in Table II.

Both *Manilkara* and *Mimusops* have alternipetalous staminodes (which distinguish these two at once from *Muriea*, which has either 12 fertile stamens and no alternipetalous staminodes, or 12 sterile stamens), and both have seeds with endosperm, which distinguishes the two from *Austromimusops* apart from the very large seed scar in the latter. Gilly, in Trop. Woods 73 (1943), p. 1-22, extended the genus *Manilkara* by including *Achras* L. This would mean that *Manilkara* Adans. (1763) has to be replaced by *Achras* L. (1753) and all the old world species of *Manilkara* apart from the American ones would have to be renamed. Gilly's interpretation is accepted by Lam and Van Royen who drew the consequences and proposed that it would be better to conserve *Manilkara* against *Achras* (see Taxon 2, 5: 112). In anticipation of adoption of this proposal for conservation, I retain the African representatives in *Manilkara*.

Twigs slender, not conspicuously zig-zag, divaricate or subverticillate; leaves not congested at the very tips of the branches;

Sepals 5-6 mm. long; staminodes about as long as the stamens, not fleshy, more or less irregularly serrate, incised or lacerate; leaves often more than 6 cm. long and over 2.5 cm. broad; petioles often more than 1 cm. long. . . . . 1. *M. zanzibarensis*.

Sepals about 3.5 mm. long; staminodes usually shorter than the filaments, more or less fleshy, occasionally with a long apical filamentous portion; leaves usually less than 6 cm. long and 2.5 cm. broad; petioles 5-8 mm. long. . . . . 2. *M. concolor*.

Twigs thick, conspicuously zig-zag, divaricate or subverticillate; leaves almost invariably crowded in fan-like groups at the very tips of the branches or on short lateral side-shoots; small trees resembling species of *Terminalia*;

Leaves quite glabrous, young ones very soon losing their pubescence; pedicels 8-12 mm. long, sparingly pubescent; sepals sparsely pubescent outside. . . . . 3. *M. mochisia*.

Leaves usually retaining vestiges of the dense pubescence of the young leaves, at least near the midrib or towards the base, rarely becoming quite glabrous; pedicels often more than 12 mm. long; sepals tomentose outside. . . . . 4. *M. macaulayae*.

1. *M. zanzibarensis* (Engl.) Dub. in Ann. Mus. Col. Marseille 23: 26 (1915); Brenan & Greenw., Tanganyika Terr. Check List. *Minusops zanzibarensis* Engl. in Pflanzenw. O. Afr., C. 307 (1895), and in Mon. Sapot. Afr. 58, t. 21, Fig. B (1904), type: *Stuhlmann* coll. No. 1, 1009 in B, holo $\gamma$ , from Zanzibar.

A large shrub or small tree up to 15 mm. high. *Branches* terete, glabrous, faintly longitudinally striate or sulcate, the ultimate ones rather uniformly leafy. *Leaves* elliptic, or obovate-oblong to (elliptic-) oblong, 3–12.5 cm., but usually 6–10 cm., long, 2–5 cm. wide, coriaceous, rather opaque but sometimes shiny with a greyish or silvery shine beneath, glabrous, obtuse, rounded or sometimes emarginate at the apex, acute at the base, with distinctly reflexed margin; midrib immersed but often more or less keeled above, very prominent and when dry longitudinally finely striate or sulcate below; secondary nerves numerous (16–25 on either side), slender, impressed hence conspicuous above, far less conspicuous beneath, straight or ascending; tertiary nerves parallel to secondary ones, but somewhat thinner and often shorter; ultimate nervation fine, reticulate, immersed and conspicuous above, less conspicuous beneath. *Petioles* stout, terete, canaliculate above, 0.5–3.5 but usually 1.2 cm. long, glabrous, in dried specimens more or less sulcate or striate below. *Flowers* trimerous, in fascicles in the axils of the leaves or of leaf-scars, few or many together; pedicels 5–8 mm. long, more or less angular, densely and shortly rusty-pubescent. *Sepals* ovate-oblong to oblong, acute, 5–6 mm. long; the outer ones about 3 mm. wide, shortly rusty-pubescent outside and whitish-pubescent inside near the margins and near the apex, with a broad base; the inner ones thinner in texture, 2–3 mm. wide, whitish-tomentose outside and glabrous inside except near the very apex, ciliate along the margins, with a narrower base. *Corolla* white, glabrous; the tube 2 mm. long, the lobes linear-oblong, 4–5 mm. at the apex, sometimes bifid and the lobes variously incised, glabrous. *Filaments* long-subulate,  $\pm$  2 mm. long; anthers biapiculate, ovate-elliptic, about as long as the filaments. *Ovary* depressed semi-globose, about 10-loculated and more or less distinctly lobed, densely covered with greyish hairs, about 0.75 mm. high and about 1.5 mm. in diameter, very abruptly narrowing into the terete, glabrous,  $\pm$  5 mm. long, truncate style. *Fruit* (according to Engler) obovoid, 10 mm. long and  $\pm$  7.5 mm. in diameter, 2–4 seeded; seeds oblong, compressed  $\pm$  8 mm. long, with a short cicatrix above the base.

*N.B.*—The figure A of tabula 21, B in Engler's monograph (1904) is not correct in that the flowers are drawn far too small although the legend mentions natural size. The other figures are properly drawn to scale.

*General Distribution.*—Coast of East Africa, from Zanzibar southwards and extending into the province of Niassa, Portuguese East Africa.

ZANZIBAR.—Imp. For. Herb. 834 leg. *Vaughan* (PRE).

TANGANYIKA.—Mafia Island, *Greenway* 5013, 5356 (PRE).

PORTUGUESE E. AFRICA.—Niassa: between Macomia and Mipande near Pto. Amelia, *Barbosa & Lenos* 2302 (LM); between Mahate and Metuge near Pto. Amelia, *Barbosa* 2346 (LM).

2. *M. concolor* (Harv. ex Wright) *Gerstner* [sphalm. ("E. Mey Gerstner")] in J. S. Afr. Bot. 14: 171 (1948).

*Mimusops concolor* Harv. ex Wright in Dyer, Fl. Cap. 4, 1: 443 (1906); type: *Gerrard & Macken* 1662 in TCD, holo, teste C. H. Wright, K. iso, from Zululand.

Although the combination "*Manilkara concolor* (Harvey) Gerstn." was erroneously published by Gerstner by putting "E. Mey" as the original author, it is evident from some of his notes and names on labels in the National Herbarium, Pretoria, that he actually meant the combination "*Manilkara concolor* (Harv.) Gerstn.", and he was credited as the author of this combination in the Index Kewensis.



A much branched large shrub or small tree, up to 15 m. but usually well under 10 m. high. *Branches* terete, greyish, more or less distinctly longitudinally fissured and with very prominent and large scars, the ultimate ones rather slender and almost invariably under 3 mm. in diameter, soon quite glabrous. *Innovations* glabrous or at least very soon quite glabrous. *Leaves* crowded at the ends of the twigs but not strictly terminal as in the next two species, varying from obovate-oblong or narrowly spatulate-oblong to oblanceolate-oblong, sometimes elliptic or elliptic-oblong, but usually narrowly spatulate-oblong or almost oblong (but with the greatest width just above the middle), 2–5 cm., rarely up to 8½ cm. long and 1–2 (–3·5) cm. wide, coriaceous, glabrous, with subreflexed margin an emarginate or retuse, rarely rounded apex, and narrowed, but never very acute, base; midrib slightly raised or subimmersed, flush or minutely keeled, but always narrow above, rather prominent below; secondary nerves very slender, inconspicuous or more or less conspicuous because they are impressed on both sides, 10–15 on either side, parallel, straight or rather straight, and ascending at an angle of 60°–90°; tertiary nerves rather few, parallel to but shorter than the secondary ones; ultimate reticulate tessellate nervation fine, immersed on both sides and as a rule distinct or conspicuous. *Petiole* semi-terete, flattened and channelled above, rather stout, 3–8 mm. long, glabrous. *Flowers* in the axils of the leaves and of scars of fallen leaves, fasciculate, often very numerous, 3-merous or sometimes 3-merous and 4-merous on one specimen; pedicels comparatively stout, terete or sub-glabrous, abruptly widening into the calyx, *Sepals* ovate or ovate-elliptic, obtuse, about 3·5 mm. long; the outer ones tomentose outside and inside near the apex, 2–2·5 mm. wide; the inner ones thinner, petaloid, slightly narrower, about 2 mm. wide, vaguely midribbed, whitish tomentose outside, glabrous inside. *Corolla* yellow or yellowish, glabrous; the tube 0·75–1 mm. long, the lobes oblong-linear or oblanceolate-spatulate, obtuse or rounded, with a very narrow, base, 3·3–5 mm. long and about 0·75 mm. wide; the appendages about as long and wide, but from a broad base lanceolate-linear, acute or acuminate, often with a few coarse serrations near the apex. *Staminalodes* sometimes fewer than the number of calyx-lobes, glabrous, fleshy, usually ovate-suborbicular or subquadrate, and much shorter than the filaments, usually more or less trilobed or tridentate, occasionally some produced in a thin filiform apical portion equalling the filaments and if so, equalling or longer than the stamens. *Filaments* 1·5–2 mm. long, glabrous; anthers somewhat sagittate, apiculate, 1–1·5 mm. long. *Ovary* 6- (or 8-) loculated, semiglobose-conical, faintly lobed, hairy, nearly 1 mm. long and about 1·25 mm. in diameter, more or less gradually passing into the rather thick, subulate, glabrous and truncate, about 2·5 mm. long style. *Fruiting* pedicels not or hardly lengthened, somewhat incrassate; calyx persistent. *Berry* 1- or 2-seeded, edible, ellipsoid or subglobose, 10–15 mm. long and 8–15 mm. in diameter. *Seeds* obovoid, hardly compressed when single, often with one flattened lateral side when from a 2-seeded fruit, obliquely truncate at the base, 9–11 mm. long 6½–8 mm. wide, those from 1-seeded fruits 5–7 mm. thick, those from 2-seeded fruits 3–5 mm. thick; testa brown, smooth and shiny, hard; scar ovate, oblong or elliptic, occupying the truncate basilateral side of the seed, 6–8 mm. long and  $\pm$  3 mm. wide.

NATAL.—Kranskop: Tugela near Jameson's Drift, Bayer 648 (NU). Mtonjaneni: Mtonjaneni. *Gerstner* 3710 (NH, PRE); Fule Drift near junction with Umhlatusi, *Gerstner* 2735 (BOL). Lower Umfolozi: Umsindusi Bridge, West 1873, 1911 (NH); Empangeni, Nagana Res. St., Kluge 30 (NH); Umfolozi Game Reserve, Ward 1467 (NH, PRE). Hlabisa: Duku-Duku forest, *Forest Dept.* FD h. No. 8603 (Pre, SAFD); near Matubatuba, *Gerstner* 8974 (NH, PRE); Hluhluwe Game Reserve, Ward 1593 (NH, PRE); False Bay, *Gerstner* 4791, 5061 (NBG, PRE), 5235 (PRE). Nongoma: about 13 m. N. of Nongoma on road to Magut, *Acocks* 13015, *Codd* 1943 (PRE); Wendelane Kloof. *Gerstner* 2522 (BOL), 4683 (NBG, PRE). Ubombo: Mkusi, Galpin 13319 (PRE).



PORTUGUESE EAST AFRICA.—Sul do Save; Lourenço Marques distr., Maputo, Santaca, *Gomes e Sousa* 3799, 3819 (COI, PRE), 3861 (PRE).

3. *M. mochisia* (Baker) Dub. in Ann. Mus. Col. Marseille 23: 26 (1915); Gerstner in J. S. Afr. Bot. 14: 171 (1948), sphalm. “(Baker) Gerstner”. *Mimusops mochisia* Baker in Oliv., Fl. Trop Afr. 3: 506 (1877); Engl., Mon. Sapot. Afr. 63, t. 22, Fig. B (1904); type: Kirk 304 from Tete, K, lecto.; fragment in PRE!.

*Mimusops densiflora* Engl., Pflanzenw. O.-Afr., C, 307 (1895), and in Mon. Sapot. Afr. 63, t. 22, Fig. C (1904), non Baker in Kew Bull. 1895: 148; type: *Stuhlmann* coll. No. 581 in herb. Hamburg, lecto.

*Mimusops menyhartii* Engl., op. cit. (1904), 63, t. 23, Fig. D; type: *Menyhart* 771 from Boruma in Z, hol., PRE, photo!.

“*Manilkara densiflora* Engl.”, Dale, in Imp. Forestry Inst. Paper 18: 25 (1939); *M. densiflora* Dale, q.e. nom. nov., ex Brenan and Greenw., Check list Tanganyika Terr. 2: 563 (1949). *M. densiflora* (Engl.) H. J. Lam in Blumea 4, 2: 355 (1941), nomen illeg. *M. menyhartii* (Engl.) H. J. Lam, op. cit., 356? *Sideroxylon fischeri* Engl. in Pflanzenw. O. Afr., C, 306 (1895). = *Mimusops fischeri* (Engl.) Engl., Mon. Sapot. Afr. 64 (1904). = *Manilkara fischeri* (Engl.) Lam in Blumea 4: 355 (1941).

A much branched deciduous large shrub or small to medium-sized tree, up to 10 m., rarely up to 15 m., high, with divaricate, subverticillate or zig-zag wise arranged, often crooked branches, resembling several African species of *Terminalia* in habit. Branches dimorphous; main shoots rather long (internodes usually 5–10 cm. long); “lateral” short branches usually under 20 mm. long; internodes of main shoots terete, rather smooth, finely longitudinally sulcate and, if not very young, glabrous and over 3 mm. thick, only the very young growing ones bearing a few leaves that are not strictly terminal. Short shoots and apices of the branches frequently somewhat thicker than the adjoining internodes, very rough with the scars of fallen leaves; youngest shoots at first pale yellowish- or whitish-tomentose, glabrescent. (New shoots are formed laterally under the terminal thickened and leaf-bearing portions of the branches and this causes the peculiar divaricate or subverticillate branching, the original terminal portion becoming a short “lateral” branch). Leaves in rather dense, more or less fan-wise spreading groups on the short lateral branches and terminal apices (apparently both lateral and terminal thickened portions of the stems being able to produce young leaves during several season in succession); young leaves almost completely glabrous as soon as they appear, the older ones quite glabrous; blade narrowly elliptic-obovate, narrowly spatulate-oblong, cuneate-oblong or more or less oblanceolate-oblong, sometimes obovate-oblong, 1.5–4 (–6) cm. long and 0.75–2 (–2.75) cm wide, coriaceous, or subcoriaceous, with a usually distinctly emarginate or retuse, sometimes rounded, apex, and narrowing towards the base, with minutely reflexed margins, drying greyish-green, paler beneath; midrib usually not very prominent on either side, but as a rule flush or slightly immersed above and slightly prominent beneath, distinct and discolorous in dried specimens; lateral nerves slender, immersed, ascending at an angle of 45°–60°; secondary nerves rather numerous (10–15 on either side), tertiary nerves not or hardly discernible from the ultimate, fine, impressed, reticulate nervation. Petioles 2–4 mm., rarely up to 7 mm., long, flattened above, on either side minutely winged by a continuation of the leaf margins. Flowers trimerous (at least no 4-merous ones seen), often appearing with the young leaves or just before the leaves, solitary or in fascicles in the axils of fallen leaves below the young growths; pedicels and calyx greenish or green tinged with brown. Pedicels 8–12 mm. long, rather slender, more or less angular, sparingly whitish pubescent, abruptly widening into the calyx. Sepals 3 + 3; the

outer ones ovate, sometimes oblong, 4–5 mm. long, 2·5–3 mm. wide, sparingly pubescent outside, pubescent inside near the apex and margins; the inner ones more petaloid, oblong, 4–4·5 mm. long and 2–2·5 mm. wide, acute, tomentose outside, glabrous inside, vaguely midribbed. *Corolla* glabrous; the tube about 1 mm. long; the lobes elliptic-lanceolate from a narrow base, obtuse or rounded; about 4 mm. long and 0·75–1 mm. wide, the appendages about as long, linear, obtuse or rounded, 0·5–0·75 mm. wide. *Staminodes* variably in size but usually much shorter than the filaments, rather fleshy, subquadrate, ovate or spatulate, trilobed, tridentate, bifid or incised, occasionally produced at the apex in a long subulate or filamentous appendage equalling the filaments, rarely even longer. *Filaments* long-subulate, about 2·5 mm. long, anthers oblong, apiculate, about 1·5 mm. long. *Ovary* 6-loculated, semiglobose-conical, about 1 mm. high and about 1·5 mm. in diameter, densely covered with rather long hairs which also cover the base of the about 3 mm. long, subulate, terete, glabrous, truncate style. *Fruiting pedicels* hardly lengthened, somewhat incrassate, fruiting calyx persistent. *Berry* ellipsoid or ellipsoid-obovoid, yellow when ripe, highly appreciated by natives

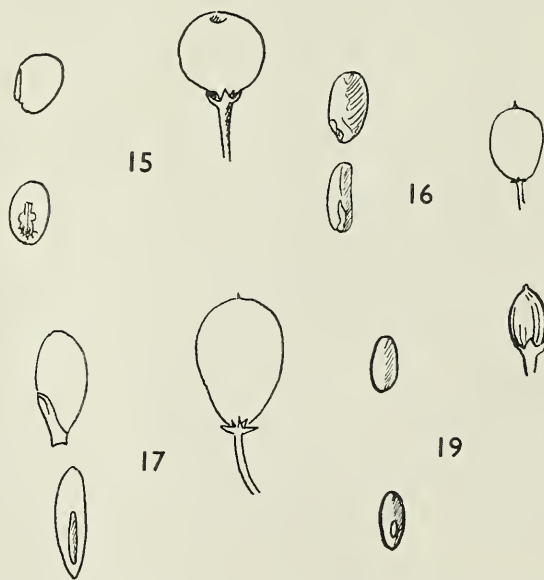


FIG. 15.—*Manilkara concolor*, seed and fruit (from Gerstner 3759, "Nangusi Forest", Zululand, in NH).

FIG. 16.—*Manilkara mochisia*, seed and fruit (from Wild 2748, Ndanga, S. Rh., in SRGH).

FIG. 17.—*Manilkara macaulayae*, seed and fruit (from Lovemore 250, Sebungwe, S. Rh., in SRGH).

FIG. 19.—*Muriea discolor*, seed and fruit (from Wood 1349, Inanda, Natal, in NH).

and baboons for the flavour, 10–12 mm. long and 8–10 mm. in diameter. those I have seen 1–3 seeded. *Seed* brown, obovate-oblong or oblong, compressed, 8–11 mm. long, 5–7 mm. wide and 3–4 mm. thick, sub-produced at the base; testa brown, rather smooth, not very shiny, hard; scar basilateral, linear-elliptic or linear, 3–5 mm. long and 0.5–1.5 mm. wide, surrounded by a rather wide, pale brown, callus-like zone which includes the whole subproduced base of the seed.

A type specimen was originally not designated, as Baker, l.c., mentions two specimens, viz., a specimen from Batoka country, N. Rhodesia and one collected near Tete (Zambezia, P.E.A.), both leg. *Kirk*. As Engler only mentions the specimen from Tete in his monograph, I propose to make this one the lecto-type (in herb. Kew.)

NATAL.—Umbombo: Otobotini, near Ndumo Game Reserve, *Gerstner* 3438 (NH).

SWAZILAND.—Probably near Stegi, *Pole Evans* 3488 (= 66).

TRANSVAAL.—Nelspruit: Kruger National Park, Skukuza, *Codd & deWinter* 4992, *van der Schijff* 1262. Pretoriuskop, v. d. *Schijff* 2014; Mbeyamide, v. d. *Schijff* 2044, 1136. Pilgrims Rest: Kruger National Park, near Skukuza *Codd* 4388; Nwanetsi, v. d. *Schijff* 320. Letaba: Kruger National Park, near Shingwedsi, *Codd & Dyer* 4660; near Letaba, *Lamont* 33. Sebasa: Punda Maria *Codd* 4238, *Codd & Dyer* 4537, v. d. *Schijff* 568, 570; Nuanetsi, *Gerstner* 6061 (all PRE).

PORTUGUESE E. AFRICA.—Sul do Save: Maputoland, Pto. Henrique, *Gerstner* 6670 (PRE); Lourenço Marques, *Borle* 144 (PRE); nr. Macia, *Pedro & Pedrogão* 1442 (PRE); nr. Chibuto, *Pedro & Pedrogão* 1535 (PRE); Guiza, *Pedrogão* 348 (PRE); nr. confluence of Limpopo and Nuanetsi Rivers (nr. Transvaal border); *Smuts* P. 332 (PRE); Maringua, Sabi Riv., *Chase* 2454 (SRGH). Zambesia: Tete, *Kirk* 304 (fragment of type in PRE, ex herb. Kew); id., Baroma, Sisitso Riv., *Chase* 2753 (SRGH); *Menyhart* 771 (Z, photo PRE!, holotype of *M. menyhartii* Engl.).

SOUTHERN RHODESIA.—Ndanga: *Wild* 2748 (SRGH); *Chase* 2367 (SRGH). Chipinga: Makosa Hills, *Phelps* 200 (PRE, SRGH). Melsetter: *Chase* 1767 (SRGH). West Nicholson: *Plowes* 1524 (PRE, SRGH).

NYASALAND.—Chiromo: *Hornby* 2902 (PRE).

TANGANYIKA.—Lindi: Lake Lutamba, *Schlieben* 5500 (PRE). In addition, the following material was kindly sent on loan from the E. African Herbarium, Nairobi, which I refer to this species:

TANGANYIKA TERRITORY.—Moa-Mwakijembe: *Kermode* AH9930. Tabora: *Forest Guard Tabora* 1517.

KENYA.—Bura, Tana Riv.: *Bally* B2805. Kitui Distr., Nzui; *Edwards* E79. Coast, Kiunga: *Elliott* OX 888; N. Giriama: *Kale* K 3663. Kibwezi: *Gibbons* K2571.

Engler describes *Mimusops mochisia* in his monograph as having staminodes often bearing a long filamentous portion at the apex (Engler, op. cit., 1904, t. 22, Fig. B, d, and in the description, op. cit., 63: “staminodiis e parte basali subquadrati in appendicem filiformem filamenta aequantem saepe productis”). Baker (l.c.) does not mention

the filiform appendages, but describes "6 minute toothed petaloid cuneate truncate glabrous staminodes". Miss Kies, our officer stationed at Kew in 1950, examined one of the original specimens (leg. Kirk at Tete), and reported that this specimen does not possess the filamentous appendages (at least not in the flowers she dissected). Upon examination of a fragment of the specimen Kirk 304 from Tete, kindly sent through the courtesy of the Keeper of the Herbarium at Kew, I came to the same conclusion. In my opinion, the shape of the staminodes in this group of *Manilkara* (Section *Iso-gyne* of Engler, op. cit., 1904) is not a constant character. Both in *Manilkara concolor* and in *M. macaulayae* a great variation in the shape of the staminodes is found, from small and subsquamiform to long-subulate, or some having filamentous appendages (see Fig. 17), and in the few flowering specimens of *M. mochia* I could examine, several different forms of staminodes were found: trilobed, spathulate, dentate, bifid, etc. Apart from the differences in the shape of the staminodes, the differences mentioned by Engler between *M. mochia*, *M. densiflora* and *M. menyhartii* are negligible. The leaf-shape reported for *M. menyhartii* is frequently found on specimens also having some longer and narrower leaves. The three type specimens are evidently only forms of one rather variable species, and *Mimusops mochia* Baker being the oldest name, the name *Manilkara mochia* (Baker) Dubard applies to all three forms under discussion. A syntype, which I propose as the lecto-type, of *Mimusops densiflora* Engl. non Baker is still extant (in herb. Hamburg) and was compared by Mr. de Winter with specimens of *M. mochia*. He reported that they are identical. An isotype of *M. menyhartii* in herb. Zürich also proved to be a good match.

*Mimusops fischeri* (Engl.) Engl., the type of which was destroyed during the last war and of which no isotypes could be traced, is most probably closely related to *M. mochia*, but I hesitate to refer it to this species, because in the description of *M. fischeri*, the innovations are reported to be densely tomentose, whereas the older leaves are said to be glabrous. The young parts of *M. mochia* are never densely tomentose in the specimens I have seen and on the other hand the older leaves of *M. macaulayae*, which species also comes into consideration, are very rarely quite glabrous, but may by an oversight have been described as glabrous in Engler's description. The old leaves are described as coriaceous which applies to *M. mochia* rather than to *M. macaulayae*. The pedicels of the type specimen, which was in bud, were described as 3–6 mm. long, which points to *M. mochia* rather than to *M. macaulayae*. Upon my request, Dr. B. Verdcourt of the East African Herbarium, Nairobi, sent me their material labelled *M. densiflora*. The specimens in question, including those from the type area of *M. fischeri*, proved to be *M. mochia* and did not include specimens referable to *M. macaulayae*. For these reasons the identity of *Mimusops fischeri* Engl. remains somewhat uncertain, but the evidence is mostly in favour of *M. mochia*, and I therefore regard *Mimusops fischeri* as a probable synonym of *M. mochia*.

The history of the name of *Manilkara densiflora* is interesting from a nomenclatural point of view, although the name falls into synonymy. Engler and Baker published the binomial *Mimusops densiflora* almost simultaneously, but for different plants. Baker's name (in Kew Bull. 1895, p. 148) antedates Engler's [Pflanzenw. Ost-Afr., C. (1895), p. 307]. Strictly speaking, all combinations based on Engler's name are invalid, but of course the name *densiflora*, not being preoccupied in *Manilkara*, can still be used for this species. Brenan and Greenway, therefore, took up the combination made by Dale as a "new name", *Manilkara densiflora* Dale. *Mimusops densiflora* Baker was reduced to *Mimusops multinervis* Baker by Engler in his Sapotaceae monograph, and



*Mimusops densiflora* Engler, as was pointed out above, becomes a synonym of *Manilkara mochisia*. *M. mochisia* is closely related to *M. concolor* and *M. macaulayae*, and resembles especially the latter very much in habit. There is no doubt that they represent three distinct species which can be distinguished as follows:

	<i>M. concolor.</i>	<i>M. mochisia.</i>	<i>M. macaulayae.</i>
Arrangement of leaves	Older leaves not strictly terminal, no short thick lateral shoots bearing leaves.	Older leaves strictly terminal, and on very short thick lateral shoots.	As in <i>M. mochisia</i> .
Pubescence....	Leaves quite glabrous..	Leaves quite glabrous	Leaves usually more or less pubescent; older ones rarely quite glabrous.
Seeds.....	Rather small, brown, smooth and shiny, not or hardly compressed, 9-11 mm. long, and 5-7 mm. thick (if one seed per fruit) or 3-5 mm. thick (more seeds per fruit).	Rather small, brown, rather smooth, not very shiny, much compressed, 9½-11 mm. long and 3-4 mm. thick.	Rather large, greyish-brown, not smooth, dull, much compressed, about 16 mm. long and 3½-4 mm. thick.
Scar.....	± 3 mm. wide, not surrounded by a callouslike zone.	½-1½ mm. wide, surrounded by a rather wide callus-like zone which includes the whole sub-produced base of the seed.	½-1 mm. wide, surrounded by a callus-like zone, which includes the whole produced base of the seed.

Although *M. mochisia* and *M. macaulayae* are distinct species, it is difficult to distinguish specimens of the latter with only glabrous old leaves from *M. mochisia*. In this case the additional characters used in the key, viz., the length of the pedicels and the pubescence of the calyx, can be used to distinguish them.

#### 4. *M. macaulayae* (Hutch. et Corb.) H. J. Lam in Blumea 4: 356 (1941).

*Mimusops macaulayae* Hutch. et Corb. in Kew Bull. 1924: 329,330, fig. A (1924); type: *MacAulay* 1002 from Northern Rhodesia in K, holo; fragment in PRE. *M. spiculosa* Hutch. et Corb., op. cit., 330, 331, Fig. B., type: *Allen* 185 from Victoria Falls in K, holo; BOL! and PRE!, isos. *M. umbraculigera* Hutch. et Corb. l.c., and Fig. C (p. 330); type: *N.N.* from Southern Rhodesia in K, holo, = SRGH No. 2639, iso!. ?*Mimusops fischeri* (Engl.) Engl., Mon. Sapot. Afr. 64 (1904).

*Manilkara spiculosa* (Hutch. et Corb.) H. J. Lam, l.c., and *M. umbraculigera* (Hutch. et Corb.) H. J. Lam, l.c.

A small to medium-sized deciduous tree up to about 15 m. high, with divaricate, subverticillate or zig-zag wise arranged, often crooked branches. Branches dimorphous: main shoots rather long (internodes usually 5-10 cm. long), lateral short branches usually ±5 - ±15 mm. long, rarely longer; internodes of main shoots terete, rather smooth with faint longitudinal fissures, striations or wrinkles and (if not very young) glabrous and at least 3-6 mm. thick, and only the very young ones bearing a few leaves that are not strictly terminal; short shoots and apices of branches frequently thicker than the adjoining internodes, very rough with the close scars of fallen leaves; youngest shoots at first densely yellowish- or pale rusty-tomentose,

glabrescent. (New branches are formed under the terminal thickened portions of the branches and this causes the peculiar divaricate or subverticillate appearance, the original terminal portion becoming a short lateral branch). *Innovations*, young leaves (mainly below), pedicels and outside of calyx-lobes with a pale buff pubescence, the latter often, and on the leaves always, turning white. *Leaves* in rather dense, more or less fan-wise spreading groups on the short lateral branches and terminal apices (apparently both terminal and lateral thickened portions of the stems being able to produce young leaves in several seasons in succession); blade narrowly elliptic-obovate to narrowly spatulate-oblong or more or less cuneate-oblong, usually rather narrow, 3-5 (-7.5) cm. long and 1-2 (-3) cm. wide, with a usually distinctly emarginate or retuse, sometimes rounded apex, narrowing to the base, with minutely reflexed margins, rather firm but not coriaceous (*M. mochisia* has more coriaceous leaves as a rule), drying an opaque green or brown, slightly paler beneath, densely tomentose or pubescent when young, at least on the lower surface, very rarely becoming quite glabrous, but usually at least retaining vestiges of an addressed whitish pubescence beneath, especially near the midrib and towards the base; midrib either slightly raised or slightly immersed, flush or minutely keeled and not very wide above, prominent beneath, usually discoloured in dried specimens; secondary nerves slender, often inconspicuous, rather numerous ( $\pm 10$  to  $\pm 15$  on either side), parallel and straight, ascending at an angle of about  $60^\circ$ , faintly raised above, subimmersed below, usually bifurcate well inside the margin and their ramifications soon merging with the finer reticulate nervation; tertiary nerves not or hardly discernible from the very fine, tessellate, reticulate nervation which is always distinct in older leaves. *Petioles* flattened and canaliculate 3-7 (-10) mm. long, glabrescent but as a rule never becoming quite glabrous. *Flowers* often appearing with or just before the young leaves, solitary or in small fascicles in the axils of fallen leaves below the young growths; pedicels and calyx of a greenish-fawn or buff colour. *Pedicels* often more than 12 mm. long, rather slender and faintly angular, abruptly widening into the calyx. *Sepals* 3 + 3 or sometimes 4 + 4; those of the outer and inner rows subequal, ovate-elliptic (3-) 4 mm. long and (2-) 3 mm. wide, but the outer ones with a broad base, the inner ones slightly thinner in texture, with a narrower base and the greatest width just above the middle, all obtuse, tomentose outside, glabrous inside except near the apex. *Corolla* glabrous, probably yellow or yellowish; the tube less than 1 mm. long, the lobes and lateral appendages subequal, oblong-lanceolate, 3-4 long and  $\pm 1$  mm. wide, rounded or obtuse at the apex. *Staminodes* sometimes fewer than the number of calyx-lobes, usually much shorter than the filaments but sometimes nearly as long, glabrous, very variable in shape, varying (often in one specimen or even in one flower) from triangular, trilobed, tridentate or subquadrate to oblong, irregularly dentate or serrate to linear-subulate or subulate from a sub-quadrate or semi-orbicular basal portion. *Filaments* subulate or linear-terete, 1.5-2 mm. long; anthers ovate-oblong or ovate-lanceolate, 1.5-2.5 mm. long. *Ovary* 6- (or 8-) loculated, ovoid-globose, more or less angular,  $1\frac{1}{4}$ - $1\frac{3}{4}$  mm. long and 1- $1\frac{1}{4}$  mm. in diameter, pubescent, more or less gradually tapering into the glabrous, long-subulate, angular to subterete and minutely truncate, 3-4 mm. style. *Fruiting* pedicels lengthening and up to 25 mm. long, slightly incrassate and ultimately about 1 mm. thick, glabrescent; calyx under fruit persistent. *Berry* ellipsoid or obovoid-oblong, with a narrow base, about 18 mm. long, 8-10 mm. in diameter, edible, the few seen all one-seeded. *Seed* obovate oblong, compressed,  $\pm 16$  mm. long,  $\pm 7$  mm. wide and  $3\frac{1}{2}$ -4 mm. thick, narrowed and more or less unequal at the base, laterally produced at the side of the scar; testa a dull greyish brown, more or less rugose, or tuberculate, hard; scar linear,  $\pm 8$  mm. long and 0.5-1 mm. wide, surrounded by a light brown and rather shiny, slightly thickened zone which is about 12 mm. long and about 3 mm. wide and includes the whole produced base of the seed.

BECHUANALAND.—Chobe: Serondela, *O. B. Miller* B/1128, B/1203, (PRE). Kachikau on road to Kasane, *Erens* 380 (PRE, SRGH). Small island in marches near Ghanzi, 22° 30' E, 19° 5' S: *Story* 4789 (PRE).

SOUTHERN RHODESIA.—“Matabeleland”: Mrs. *Pardy* s.n. (SRGH No. 5027). Urungwe: *Wild* 4163 (PRE, SRGH). Sebungwe: *Lovemore* 250 (SRGH). Hartley: Umsweve River, *Hodgson* H. 35/48 (SRGH); Gatooma, *Golding* s.n. (SRGH No. 31015, 31267); *Eyles* in QVM. Herb. No. 7264, 7507 (SRGH); Hartley: *Eyles* in QVM. Herb. No. 7507 (SRGH). Wankie: Wankie Camp, *Pole Evans* 2751 (PRE, SRGH); Victoria Falls, *Allen* 185 (isotype of *Mimusops spiculosa*. Hutch et Corb., (PRE, BOL); *Galpin* 7052 (PRE); *Wild* 3088, 3106 (SRGH). Bulawayo: *Hodgson* s.n. (PRE, SRGH). Without precise locality: *N.N.* in SRGH 2639 (isotype of *Mimusops umbraculigera* Hutch. et Corb.); specimen sent by *Dept. of Munitions*, S. Rh., to Bolus Herb (BOL. 25013).

NORTHERN RHODESIA.—Victoria Falls, N. bank, *Pole Evans* 2751 (8) (PRE, SRGH) Lusaka: Mumbura, *MacAulay* 1002 (fragment of type of *Mimusops macaulayae*, PRE).

A study of the few flowering specimens I have seen (including a fragment of the type specimen and, in addition, isotypes of *Mimusops spiculosa* and *M. umbraculigera*) showed that the staminodes are very variable in shape and length and that in a single flower triangular, serrate, bifid, dentate and subulate ones may occur (Fig. 18). In the isotype of *M. umbraculigera*, I found bifid and triangular staminodes apart from the irregularly dentate ones described in the species diagnosis by Hutchinson and Corbishley; in the isotype of *M. spiculosa* bifid ones occur apart from the subulate ones mentioned in the original species diagnosis. In *Faulkner* (A) 64 such a great variation is found (see Fig. 18), that I am convinced that the three species described by Hutchinson and Corbishley, are conspecific. Apart from the character of the staminodes, the differences they mentioned are very slight and as far as I have seen, not constant (such as the shape of the filament, relative lengths of filaments and anthers, pubescence) so that there is no reason to distinguish more than one species. As regards the possible identity with *Mimusops fischeri* Engl., see the discussion under *Manilkara mochisia*.

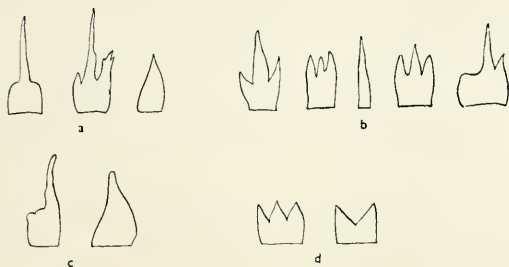


FIG. 18.—Shapes of staminodes in *Manilkara macaulayae*: (a) 3 staminodes found in one flower of *Faulkner* (A) 64 from Angola; (b) 5 staminodes of another flower of the same specimen; (c) 2 staminodes from isotype of *Mimusops umbraculigera* (SRGH No. 2639 from Rhodesia); (d) 2 staminodes out of one flower of *O. B. Miller* B/1128 from Bechuanaland.



## 9. MURIEA

- Hartog* in J. Bot. 16: 145 (1878) (diagnosis on p. 72 sub. *Eichleria* Hartog); Dubard in Ann. Mus. Col. Marseille 23: 28 (1915); H. J. Lam in Blumea 4: 348 (1941) and Table 1 (p. 350). *Eichleria* Hartog in J. Bot. 16: 72 (1878), non *Eichleria* Progel in Mart., Fl. Bras. 12, 2: 518 (1877).  
*Labourdonnaisia* Boj. ex parte, Benth. & Hook, Gen. Pl. 2: 659 (1876); Gerstner in J. S. Afr. Bot. 12: 40 (1946).  
*Mahea* Pierre, Not. bot. Sapot. 8 (1890).  
*Mimusops* L. sect. *Muriea* Hartog in J. Bot. 17: 358 (1879).  
*Mimusops* L., subgenus *Ternaria* (A. DC) Engl., sect. *Euternaria* Engl., subsect. *Muriea* (Hartog) Engl. in Mon. Sapot. Afr. 55 (1904), and sect. *Mahea* (Pierre) Engl., op. cit., 65.  
*Mimusops* L., ex parte, C. H. Wright in Dyer, Fl. Cap. 4, 1: 439 (1909), p. 439; Phillips in Genera S. Afr. Flow. Pl., ed. 2: 568 (1951).

Type species: *Labourdonnaisia discolor* Sond. in Linnæa 23: 73 (1850) = *Muriea discolor* (Sond.) Hartog.

Trees with exstipulate, parallel-nerved leaves. *Flowers* trimerous, axillary, solitary or in fascicles. *Sepals* 3 + 3; corolla with short tube and 6 lobes, these lobes either bearing two lateral appendages (in this case 12 fertile stamens, sub-biserial: 6 epipetalous and 6 alternipetalous) or the lateral appendages reduced, sometimes 0 (in this case usually stamens more or less sterile and transformed into subulate staminodes). *Stamens* inserted in the throat of the corolla tube. *Ovary* 6-loculated, hairy; style long-cylindric-subulate; ovules with basal or basilateral attachment. *Berry* (always?) 1-seeded. *Seed* with basilateral, oblong or elliptic scar; testa rather thin and brittle; endosperm copious; cotyledons thin, foliaceous.

Number of species: At least one in the coastal regions of Southern East Africa, possibly one or two more in tropical East Africa (if not conspecific with the first) and, according to Hartog (1878) and others, another species in the West Indies.

The nomenclature of the type species *Muriea discolor* (Sond.) Hartog is rather complicated. Sonder described it as a *Labourdonnaisia* and it was included in this genus by Bentham and Hooker in Gen. Pl. 2: 659. Hartog (1887) pointed out that the petals in *Labourdonnaisia* are equal and placed in one whorl, their number varying from 12–17, with an equal number of stamens, whereas the species described by Sonder has 6 corolla lobes with each 2 lateral appendages. On account of this difference, among other things, Hartog decided that the plant belongs to a different genus, which he described as *Eichleria*. This name being illegitimate on account of *Eichleria* Progel, Hartog changed the name to *Muriea*. A year later, he regretted this decision and included his genus *Muriea* as a section in his large genus *Mimusops* which comprised practically all the Sapotaceae—Mimusopoideae. Engler (1904), whose conception of *Mimusops* agrees with that of Hartog, included *Muriea* as a subsection of his section *Euternaria* (the greater part of which is now generally recognised as belonging to the genus *Manilkara* Adans.)

Dubard in 1915 resuscitated *Muriea*, which genus he placed near his section *Mahea* of *Manilkara*, on account of the absence of staminodes.

Baehni in Candollea 7: 467 (1938), reduces *Muriea* to *Mimusops*, which is altogether incomprehensible to me, because Baehni, op. cit., 465–466 excludes all forms with 3-merous flowers from *Mimusops* (and includes most of them in *Manilkara*).

*Mahea* Pierre remained a more or less problematic genus for a long time. Engler (1904) reduced it to a section *Mahea* of a large genus *Mimusops*. Dubard (op. cit., 27) reduced *Mahea* to a section of *Manilkara*. Baehni (op. cit., 461) follows Dubard.



Gerstner in J. S. A. Bot. 12: 49 (1946), finally, resuscitated the name *Labourdonnaisia discolor* Sond. In a subsequent publication in J. S. Afr. Bot. 14: 173 (1948), Gerstner pointed out that the anthers and the corolla-segments of this plant are reduced when the flowers develop in dry weather, or if the tree is not growing on fertile soil. He distinguished four *formae*, a *forma perfecta* and three progressively more depauperate forms. The most depauperate form corresponds with *Mahea natalensis* Pierre, so that *Mahea* becomes a synonym of *Muriea*\*. Incidentally, a specimen of *Wood* 1134 (type number of *Mahea natalensis* Pierre) in BOL bears fruits and its fruits and seeds are identical with those of *Muriea discolor*.

The synonymy of the plant described as *Mahea natalensis* Pierre is also rather complicated. Engler, when he reduced *Mahea natalensis* to *Mimusops*, made the combination *Mimusops natalensis* (Pierre) Engl. (1904). However, Schinz had validly published as specific name *Mimusops natalensis* Schinz in Bull. Herb. Boiss. 4: 441 (1896) and Engler renamed this species *Mimusops schinzii* Engl. Under the present rules, *M. natalensis* (Pierre) Engl. is illegitimate, being antedated by *M. natalensis* Schinz. The first name becomes a synonym of *Labourdonnaisia discolor* Sond., the second of *Mimusops marginata* N.E. Br. [= *Austromimusops marginata* (N.E. Br.) A. Meeuse, quod vide, see p. 350].

My reasons for resuscitating *Muriea* Hartog, at least for the species *Labourdonnaisia discolor* Sond., are the following:

1. *Labourdonnaisia* was described as having 12–18 equal corolla-lobes (and not 6 lobes each with 2 lateral appendages) and 12–17 stamens, sometimes with a few staminodes, whereas *Muriea* has 6 corolla-lobes, each having, in perfect flowers, 2 lateral appendages, and always 12 stamens (or rarely 12 staminodes).

2. *Labourdonnaisia* is reported to have a large and basal seed scar, whereas *Muriea* has a basiventral, rather narrow seed scar. *Muriea* has its affinities clearly with *Manilkara*; it is, in fact, a *Manilkara* with normally 6 + 6 stamens instead of 6 stamens + 6 alternipetalous staminodes. Its habit is also very much that of a *Manilkara* (parallel substriate nervation of the leaves, etc.). However, the absence of alternipetalous staminodes distinguishes it clearly from *Manilkara*.

The synonymy of the only South African species, therefore, becomes as follows:—

**M. discolor** (Sond.) Hartog in J. Bot. 16: 145 (1878); Dubard in Ann. Mus. Col. Marseille 23: 28 (1915).

*Labourdonnaisia discolor* Sond. in Linnaea 23: 73 (1850); Gerstner in J. S. Afr. Bot. 12: 49 (1946), and 14: 173 (1948); Syntypes: *Gueinzius* 128 and *Gueinzius* 547 from Durban, Natal, in herb. Sonder nunc S. *L. sericea* Benth. et Hook. f., Gen. Pl. 2: 660, (1876), nomen.

*Eichleria discolor* (Sond.) Hartog in J. Bot. 16: 72 (1878).

*Mimusops discolor* (Sond.) Hartog in J. Bot. 17: 358 (1879); Engl., Mon. Afr. Sapot. 55, t. 34, Fig. A (1904); C. H. Wright in Dyer, Fl. Cap. 4, 1: 440 (1906).

*Mahea natalensis* Pierre, Notes Bot. Sapot. 10 (1890); type: probably *Wood* 1134, holo in P?, also in BOL, GRA.

*Mimusops natalensis* (Pierre) Engl., Mon. Afr. Sapot. 65, t. 25, Fig. B (1904) non *Mimusops natalensis* Schinz (1896); C. H. Wright, l.c.

A medium-sized tree, 10–20 m. high with a stem diameter up to about 60 cm. with grey, longitudinally fissured bark; on young branches the bark is smoother and often full of leaf-scars. *Ultimate branches* rather stout (at least 1.5 mm. thick), terete.

\* This reduction of the lateral appendages in one species could possibly occur in the related genus *Manilkara* and that is why, to my mind, the species of Gilly's subgenus *Manilkariopsis* (Trop. Woods 73: 9) should be re-examined in the light of Gerstner's observations on *Muriea*, i.e., in relation to prevailing ecological conditions at the time of flowering.

*Innovations* shortly puberulous-tomentose, the pubescence cinnamon-coloured; older parts except the lower surface of the leaf very soon glabrous. *Leaves* more or less distinctly crowded at the tips of the branches, rather uniform in shape, almost invariably obovate-oblong, sometimes oblong, or more or less spatulate- or lanceolate-oblong, narrowed but usually not distinctly cuneate at the base, with a rounded, obtuse, subacute or very shortly acuminate and usually recurved, almost invariably emarginate apex, green above (often drying brown or greyish-brown), densely adpressed-silvery pubescent beneath, except on the midrib, with slightly recurved margins, 3.5–7 (–10) cm. long, 1.5–3.5 (–4.5) cm. wide; midrib immersed and distinctly channelled above, very prominent beneath, at first finely rusty-pubescent, ultimately glabrous and of a different colour than the silvery lower surface of the leaf (yellowish brown or dark brown when dry); secondary nerves 10–15 or more on either side, straight, ascending at an angle of 70°–90°, archingly joining near the margin, immersed but rather conspicuous above, immersed and partly hidden by the silvery tomentum below; tertiary nerves parallel to the secondary ones, usually inconspicuous below, but appearing as a fine striation above; fine ultimate nervation reticulate, usually invisible below except in the oldest leaves, but distinct and impressed above and giving the upper surface of the leaf a minutely tessellate, dull appearance. *Petioles* terete, hardly thickened towards the base, narrowly canaliculate above, glabrous, 6–15 mm. long. *Flowers* in few-flowered fascicles (often about 3 together). *Perfect flowers*: pedicels 5–10 mm. long, rusty-pubescent; *flower-buds* rounded at the top, broadly obovoid,  $\pm$  5 mm. long and 3–4 mm. in diameter; *sepals* almost completely free; the three outer ones rather coriaceous, broadly ovate, narrowed towards the tip, but not acute,  $\pm$  5 mm. long and  $\pm$  4 mm. wide, rusty-pubescent outside, subciliate, glabrous inside except near the apex, the inner ones narrower, 5–5.5 mm. long and  $\pm$  3 mm. wide, yellowish, whitish adpressed-pubescent outside and near the apex inside; *corolla* white or yellowish; tube 1.5–2 mm. long, cylindric; the lobes long-spatulate with a long-tapering, narrow base and rounded top, the appendages broader, lanceolate-oblong or linear, acuminate, all segments 3–3.5 mm. long; *filaments* 2–2.5 mm. long, filiform and slender; anthers 1.5–2 mm. long, ovate-cordate, apiculate; *ovary* depressed-conical,  $\pm$  1 mm. high and  $\pm$  1 mm. in diameter, densely sericeous-pilose; style glabrous cylindric, 3–3.5 mm. long, rather gradually tapering into the flat, subcapitate and  $\pm$  6-lobed stigma. *Imperfect flowers* on short pedicels (sometimes under 5 mm. long), often considerably smaller (e.g., calyx and corolla lobes only 2 mm. long); *corolla lobes* with reduced lateral appendages, trifid, tridentate or entire; *anthers* very small or wanting or sometimes developed, *ovary* and *style* as above but sometimes ovary more subglobose and style only  $\pm$  2 mm. long. *Fruit* spherical, edible and red when ripe, according to Gerstner (1946), but when dried ellipsoid, 8–12 mm. long and 5–10 mm. wide, crowned by the persistent style. *Fruiting pedicels* not appreciably lengthened or incrassate; fruiting calyx adpressed to the fruit. *Seed* elliptic in outline, compressed,  $\pm$  8 mm. long,  $\pm$  5 mm. wide, and  $\pm$  3.5 mm. thick in the middle; scar basilateral, oval or elliptic, 3–4 mm. long, and 1–2 mm. wide in the widest place; testa pale fawn-coloured when dry, thin and brittle.

*Distribution*.—Natal, from Durban northwards, Zululand, Swaziland, P.E. Africa and extending into East Tropical Africa.

NATAL.—Durban: *Thorns* s.n. (NH No. 40612, PRE); Durban, Albert Park, *Van der Byl* s.n. (HN No. 16245 and 16246 in NH, GRA); Gerstner 4703 (PRE). Butcher (= Gerstner 4712) (PRE, SRGH); Gerstner 6820 (NBG, PRE). Pinetown: Umzinyati, Wood 11440 (PRE, NU, J). Ndwedwe: Inanda, Wood 1134 [GRA, BOL, one of the numbers cited by Engler sub. *Mimusops natalensis* (Pierre) Engl.], 1349 (NH, BOL, SAM). Palmiet, Wood 8378 (NH, NU, PRE). Lower Tugela: Darnal, Schmidt 39, 40 (NH). Hlabisa: near Hlabisa, Gerstner 4117 (NH, PRE) 4527 (PRE); Emganga, Gerstner 5077 (RE, BOL, NBG); Hluhluwe Game Reserve, Ward 2639

(NH, PRE), "Zululand"; *Gerstner* 2539 (BOL). Ubombo: Bangazi Lake, *Boocock* FD herb. No. 5720 (PRE, SAFD). Swaziland (?): Mangusi Forest (prob. near Hlatikulu) FD. Herb. No. 5314 (PRE, SAFD).

PORTUGUESE EAST AFRICA.—Sul do Save: Maputo, *Sim* 20992 (NU, PRE); Lourenço Marques: *Oliveira* 74 (LM); Inhaca Island, Mrs. *Moss* (J. No. 27637, also PRE) between Chongoene and Chidinguel: *Pedro* 247 (PRE); Chibuto e Vila Gomez da Costa, *Pedro & Pedrogão* 1559 (PRE). "Zavala Distr.," Afr. Mus. Res. Libr. III (PRE); Inhambane, *Gomes e Sousa* 1657 (PRE, COI), 1949 (COI); Inhambane, Maxixe, *Amostra* 1 (LM). Manica e Sofala: Macuacua, *Simão* 1251 (PRE); Gazaland, *Earthy* 27 (PRE); Masiyeni, *Earthy* 169 (PRE). Niassa: Porto Amelia, *Barbosa* 1865 (LM), *Barbosa & Lemos* 2031 (PRE); entre Pundankas e Nanga, *Barbosa* 2190 (PRE).

SOUTHERN RHODESIA.—Umtali: *Chase* 4664, 4559, 5722, *Ball* 1 (PRE, SRGH).

As this species is most probably found in other parts of tropical East Africa, it is not unlikely that it was described from this area under a different name. It is quite likely that Engler's species *Mimusops buchananii* in Pflanzenw. O. Afr., C, 307 (1895) and in Mon. Sapot. Afr. 56, t. 19, Fig. B (1904) and *Mimusops altissima* Engl., op. cit. (1904), 55, are referable to this species. These two have 12 stamens and the descriptions (and Figure of *M. buchananii*) agree very well indeed. This would extend the range of *Muriea discolor* to Nyasaland and Tanganyika.





# An Enumeration of the *Maytenus* Species of Southern Africa.

By

W. Marais.

The revision of the South African *Celastraceae* by Davison in *Bothalia* 2: 289–346 (1927), was, for many years, the latest work available in South Africa. Loesener's treatment of the family in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2, 20b: 87–197 (1942), did not become available until several years after the war. He transferred the unarmed African species of *Gymnosporia* to *Maytenus*, a genus which had, up to that time, been regarded as being restricted to tropical and subtropical America.

Exell in *Bol. Soc. Brot.*, Sér. 2, 26: 222 (1952) regards *Gymnosporia*, as defined by Loesener, as too artificial to be maintained, and transfers several of the armed species to *Maytenus*. Brenan in *Mem. N.Y. Bot. Gard.* 8: 238 (1953) and Blakelock in his series of notes on African *Celastraceae* [the first in *Kew Bull.* 1956: 237 (1956)] also hold the view that the separation of the two genera on a basis of the presence or absence of spines and short shoots is unsatisfactory when the supposed difference of a two-loculed versus a three-loculed ovary breaks down.

Ding Hou in *Ann. Miss. Bot. Gard.* 42: 215–302 (1955) expresses the view that *Gymnosporia* and *Maytenus* are distinct, though very closely related, and provides a tabular key using a large number of characters. After a careful comparison, however, there seems to be no character or combination of characters constant enough to justify the retention of *Gymnosporia*.

The following key and enumeration is tentative, but it has become imperative to make the combinations under *Maytenus* and to try and clarify some of the specific-level problems.

See Taxon 3: 196 (1954) for the proposal to conserve the generic name *Maytenus* H.B.K.

My thanks are extended to the Directors of all the herbaria who kindly sent material on loan to Kew.

Flowers in axillary fascicles, common peduncle none or less than 2 mm. long; plants unarmed and without short shoots; internodes sometimes much abbreviated, but leaves never in true fascicles:

Leaves with resinous threads on being broken..... *M. acuminatus*.

Leaves without resinous threads:

Leaves entire, suborbicular, obovate to obovate-elliptic..... *M. lucidus*.

Leaves variously dentate, serrate or angled:

Capsules yellow, orange to orange-brown; leaves green or yellow-green; margin strongly revolute with 3–5 (rarely 6) teeth or angles on either side; apex rounded or obtuse..... *M. procumbens*.

Capsules greenish or whitish, never brightly coloured; leaves green, grey-green or whitish on lower surface; margin flat or slightly revolute, obscurely angled to sharply and spinously dentate or serrate, usually with more than 6 teeth on either side; apex often acute or acuminate, but some rounded or obtuse..... *M. undatus*.

Flowers in cymes; cymes axillary or appearing fascicled on short shoots; peduncle sometimes reduced, but then plants armed and with short shoots; leaves often fascicled:

Plants unarmed and without short shoots; leaves never fascicled:

Leaves with resinous threads on being broken..... *M. acuminatus*.

Leaves without resinous threads:

Plants, or at least the young parts pubescent..... *M. peduncularis*.

Plants glabrous:

Leaf-margin closely serrulate; blade narrowly lanceolate; veins prominent on lower surface..... *M. bachnanii*.

Leaf-margin entire; blade broadly ovate to narrowly lanceolate, thick and leathery with veins more or less immersed..... *M. oleoides*.

Plants armed and with short shoots; leaves often fascicled:

Young parts puberulous or pubescent:

Leaves lanceolate, oblanceolate or narrowly elliptic, entire or scarcely dentate.

Capsule papery. Flowers greenish-white to cream..... *M. tenuispinus*.

Leaves ovate to ovate-elliptic, closely serrate or crenate-serrate; capsule leathery to almost woody; flowers pink to red..... *M. mossambicensis* var. *ruber*.

Plants glabrous:

Ovary two-celled:

Leaves oblanceolate to obovate, finely and regularly serrate..... *M. senegaleusis*.

Leaves linear to lanceolate or lanceolate-oblong, entire, repandly dentate or coarsely serrate..... *M. linearis*.

Ovary three-celled:

Leaves entire or nearly so; bark developing very early on young twigs which are brown or whitish, sometimes longitudinally wrinkled but not angular-striate (see also *M. cymosa*):

Leaves obovate-cuneate, thick, the veins usually completely immersed; capsule thick, woody..... *M. capitatus*.

Leaves oblanceolate or oblanceolate-oblong, often discolorous, the veins raised, at least on lower surface; capsule thin-leathery..... *M. polyacanthus*.

Leaves serrate, dentate or crenate-serrate, rarely almost entire, but then young twigs usually green and angular-striate:

Mature leaves thin, ovate or ovate-lanceolate, often rounded at the base or broadest below the middle; margin often sharply serrate; twigs slender, often reddish; inflorescence very lax, often few-flowered, with long, slender main branches

*M. mossambicensis*  
var. *mossambicensis*.

Mature leaves leathery to very thick leathery, variable in shape, often cuneate and broadest above the middle, except for leaves on young growth, or else very thickly leathery if rounded at the base; margin crenate-serrate to subentire or entire; twigs brown, grey or green; inflorescence lax to very dense, with rather stout or short main branches:

Leaf margin revolute; blade more or less elliptic above the distinct petiole, almost invariably drying brownish, discolorous; spines absent or present, the whole or at least their tips often shiny dark-brown; twigs sometimes longitudinally wrinkled but often striate with definite raised lines

*M. nemorosus*.

Leaf-margin usually flat; blade very variable in shape and texture, but not often as above; petiole sometimes distinct but when blade cuneate it is often decurrent on the petiole; usually drying green or grey-green, only rarely discolorous; spines absent or up to 20 cm. long, but never shiny dark-brown; twigs often strongly angled or striate.... *M. cynosus*.

1. **M. lucidus** (L.) Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 140 (1942).  
*Celastrus lucidus* Linn., Mant. 49 (1767); Sond. in Harv. & Sond., Fl. Cap. 1: 456 (1860).  
*Gymnosporia lucida* Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 208 (1892); Davison in Bothalia 2: 294 (1927).
2. **M. procumbens** (L.f.) Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 140 (1942).  
*Celastrus procumbens* Linn. fil., Suppl.: 153 (1781); Sond., l.c. 457.  
*Gymnosporia procumbens* Loes. in Engl., Bot. Jahrb. 39: 169 (1906); Davison, l.c. 297.
3. **M. undatus** (Thunb.) <sup>Loes.</sup> Blake in Kew Bull. 1956: 237 (1956).  
*Celastrus undatus* Thunb., Prodr. Pl. Cap.: 42 (1794); Sond., l.c.  
*C. ilicinus* Burch., Trav. Int. S. Afr. 1: 340 (1822); DC., Prodr. 2: 7 (1825).  
*Catha fasciculata* Tul. in Ann. Sci. Nat., Sér. 4, 8: 98 (1857).  
*Celastrus zeyheri* Sond., l.c. 456.  
*Gymnosporia undata* Szyszyl., Polypet. Discifl. Rehmann.: 34 (1888); Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 208 (1892); Davison, l.c. 296.  
*G. rehmannii* Szyszyl., l.c.; Loes., l.c.  
*G. zeyheri* Szyszyl., l.c. 33; Loes. in Engl., Bot. Jahrb. 17: 548 (1893); Davison, l.c. 294.  
*G. fasciculata* Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 208 (1892); Davison, l.c. 298.  
*Celastrus albus* N.E. Br. in Kew Bull. 1906: 16 (1906).  
*Gymnosporia deflexa* Sprague in Kew Bull. 1906: 246 (1906); Davison, l.c. 299.  
*G. albata* Sim, For. & For. Fl. Col. Cape Good Hope: 186 (1907); Davison, l.c.  
*G. ilicina* Loes. in Engl., Pflanzenw. Afr. 3, 2: 225 (1921); Davison, l.c. 296.  
*G. peglerae* Davison, l.c. 298.  
*Maytenus ilicinus* Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 140 (1942).  
*M. fasciculatus* Loes., l.c.  
*M. zeyheri* Loes., l.c. 138.
4. **M. oleoides** (Lam.) Loes., l.c. 137.  
*Celastrus laurinus* Thunb., l.c. non *Maytenus laurinus* Briq. 1919.  
*C. oleoides* Lam., Tabl. Encycl. & Meth. 2: 293, No. 2696 (1797).  
*Scytophyllum laurinum* E. & Z., Enum. Pl. Afr. Austr.: 124, No. 966 (1834-5); Sond., l.c. 471.  
*Scytophyllum angustifolium* Sond., l.c. 472.  
*Gymnosporia laurina* Szyszyl., l.c. 35; Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 208 (1892); Bolus & Wolley-Dod in Trans. S. Afr. Phil. Soc. 14: 247 (1903); Davison, l.c. 310.  
*G. angustifolia* Loes., l.c.; Bolus & Wolley-Dod, l.c.; Davison, l.c. 300.  
*G. monococca* Davison, l.c.  
*Maytenus monococcus* Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 138 (1942).  
*M. angustifolius* Loes., l.c.
5. **M. acuminatus** (L.f.) Loes., l.c.  
*Celastrus acuminatus* Linn. fil., l.c. 154 (1781); Sond., l.c. 454.  
*C. cordatus* E. Mey. ex Sond., l.c.  
*Gymnosporia acuminata* Szyszyl., l.c. 33; Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 208 (1892); Davison, l.c. 311.

*C. cordata* Sim, l.c. 184; Davison, l.c. 300.

*Maytenus cordatus* Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 138 (1942).

*Gymnosporia filiformis* Davison in Bothalia 2: 311 (1927), may belong here. All the flowers examined showed a 5-celled ovary with more than 2 ovules in each cell. More material is required before this can be cleared up.

6. **M. peduncularis** (Sond.) Loes., l.c. 136.

*Celastrus peduncularis* Sond., l.c.

*Gymnosporia peduncularis* Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 208 (1892); Davison, l.c. 308.

7. **M. bachmannii** (Loes.) Marais, comb. nov.

*Gymnosporia bachmannii* Loes. in Engl., Bot. Jahrb. 19: 232 (1894); Davison l.c.

8. **M. capitatus** (E. Mey. ex Sond.) Marais, comb. nov.

*Celastrus capitatus* E. Mey. ex Sond., l.c. 458.

*Gymnosporia capitata* Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 207 (1892); Davison, l.c. 293; Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20 b: 150 (1942).

9. **M. polyacanthus** (Sond.) Marais, comb. nov.

*Celastrus polyacanthus* Sond., l.c. 455.

*Gymnosporia polyacantha* Szyszyl., l.c. 34; Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 207 (1892); Davison, l.c. 302; Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 150 (1942).

*G. vacciniifolia* Conrath in Kew Bull. 1908: 211 (1908); Davison, l.c. 303.

10. **M. tenuispinus** (Sond.) Marais, comb. nov.

*Celastrus tenuispinus* Sond., l.c. 456.

*Gymnosporia tenuispina* Szyszyl., l.c. 33; Davison, l.c. 306; Loes., loc. cit.

*G. botsabelensis* Loes. in Bull. Herb. Boiss. 4: 429 (1896).

11. **M. linearis** (L.f.) Marais, comb. nov.

*Celastrus linearis* Linn. fil., l.c. 153; Sond., l.c. 455.

*C. lanceolatus* E. Mey. ex Sond., l.c. 456.

*Gymnosporia linearis* Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 207 (1892) Davison, l.c. 305; Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 149 (1942).

*G. lanceolata* Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 207 (1892); Davison, l.c.; Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 149 (1942).

12. **M. senegalensis** (Lam.) Exell in Bol. Soc. Brot., Sér. 2A, 26: 223 (1952).

*Celastrus senegalensis* Lam., Encycl. Meth. Bot. 1: 661 (1785).

*Gymnosporia senegalensis* Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 207 (1892); Davison, l.c. 320; Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 147, 149 (1942).

*G. dinteri* Loes. in Bull. Herb. Boiss., Sér. 2, 3: 823 (1903).



13. **M. mossambicensis** (Klotzsch) Blakelock in Kew Bull. 1957: 37 (1957) var. **mossambicensis**.

*Celastrus mossambicensis* Klotzsch in Peter's Reise Mossamb. Bot. 112 (1861).  
*Gymnosporia mossambicensis* Loes. in Engl., Bot. Jahrb. 17: 547 (1893); in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 152 (1942).

*Celastrus concinnus* N.E. Br. Kew Bull. 1906: 16 (1906). G. = = =

var. **ruber** (Harv.) Blakelock, l.c.

*Celastrus ruber* Harv. in Harv. & Sond., Fl. Cap. 2: 592 (1862).

*Gymnosporia rubra* Loes., l.c.; Davison, l.c. 309; Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 150 (1942).

14. **M. nemorosus** (E. & Z.) Marais, comb. nov.

*Celastrus nemorosus* E. & Z., l.c. 129, No. 938; Sond., l.c. 460.

*Gymnosporia nemorosa* Szyszyl., tom. cit.: 35; Davison, tom. cit.: 316.

15. **M. cymosus** (Soland.) Exell, l.c. 222.

*Celastrus buxifolius* Linn., Sp. Pl.: 197 (1753) pro parte, excl. Tab. Plukenet; Sond., l.c. 459; non *Maytenus buxifolius* Griseb.

*C. ellipticus* Thunb. in Hoffm., Phytogr. Blaett. 1: 22 (1803); Thunb., Fl. Cap. 119 (1818); Sond., l.c. 458; non *Maytenus ellipticus* Krug. & Urb. ex Duss. (1897).

*C. cymosus* Soland. in Sims, Bot. Mag. t. 2070 (1819).

*C. heterophyllus* E. & Z., l.c. 120, No. 943; Sond. l.c.

*C. angularis* Sond., l.c. 460.

*Gymnosporia buxifolia* Szyszyl., l.c. 34; Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 207 (1892); Davison, tom. cit.: 317; Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 152 (1942).

*G. woodii* Szyszyl., l.c. 35; Loes., l.c.

*G. heterophylla* Loes. in Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 207 (1892); Davison, l.c.; Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 152 (1942).

*G. condensata* Sprague in Kew Bull. 1906: 246 (1906); Davison l.c. 305.

*G. angularis* Sim, l.c. 186; Davison, l.c. 314.

*G. elliptica* Schönl. in Bot. Surv. Mém. S. Afr. 1: 73 (1919); Davison, l.c. 306.

*G. angularis* var. *orbiculata* Davison, l.c. 316.

*G. angularis* var. *grandifolia* Davison, l.c.

*G. cratoegiflora* Davison, l.c. 314; Loes., l.c. in syn.

*G. uniflora* Davison, l.c. 294.

Solander, in his manuscript in the library of the British Museum of Natural History, gives the following reference: "H.S. 261. 34. Habitat ad Prom. b. spei (Desmaretz)." Vol. 261 in the Sloane Herbarium contains plants collected by Desmarest at the Cape. The specimen on p. 34 must be the type of *Celastrus cymosus* Soland., and not the specimen figured on Bot. Mag. t. 2070. I can trace no specimen of the figured plant, which seems to be nearer to the form described as "*Gymnosporia angularis*".

It has not been possible to ascertain the identity of all the species described from South African plants. Those not identified are as follows:—

*G. eremocusa* Loes. in Engl., Bot. Jahrb. 41: 299 (1908).

The type of this has been destroyed. Judging from the description I have no doubt that it is the same as *M. senegalensis* (Lam.) Exell.

*G. crenulata* Engl., Bot. Jahrb. 10: 38 (1888).

Type destroyed. I have examined several sheets that have been called by this name, but they all belong to either *M. cymosus* (Soland.) Exell or *M. senegalensis* (Lam.) Exell.

*G. acanthophora* Loes. in Engl., Bot. Jahrb. 41: 299 (1908).

The type has been destroyed. All material that I have seen under this name belongs to *M. cymosus* (Soland.) Exell.

*Maytenus rudatisii* (Loes.) Loes. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 20b: 138 (1942). *G. rudatisii* Loes. in Engl., Bot. Jahrb. 41: 307 (1908).

I have not been able to locate the type specimen; it has probably been destroyed. From the description it seems to be related to *Cassine eucleaeformis* (Sond.) O. Ktze.

*G. schlechteri* Loes. in Bull. Herb. Boiss. 2: 193 (1894).

Schlechter 241 differs from *M. cymosus* (Soland.) Exell in the very lax and slender inflorescences, and its leaves are somewhat narrower than those of other specimens from the Cape Peninsula. It seems remarkable that no other material like it is available from such a well-collected area, and I am inclined to regard it as just another local form of the extremely variable *M. cymosus* (Soland.) Exell.

*G. integrifolia* (L.f.) Glover in Ann. S. Afr. Mus. 9: 206 (1915).

I have not yet been able to examine any authentic material. All the specimens quoted by Davison were misidentified; most of them belong either to *Maytenus cymosus* (Soland.) Exell or to *Putterlickia pyracantha* (L.) Endl.

*G. saxatilis* (Burch.) Davison in Bothalia 2: 303 (1927). *Celastrus saxatilis* Burch., Trav. Int. S. Afr. 2: 264 (1824).

Burchell cites only his No. 1671, which has 6 ovules per locule and therefore belongs to *Putterlickia*. In making the new combination, Davison added 3 more Burchell specimens. One of these is a sterile scrap, and both the others are, like the type, *Putterlickia pyracantha* (L.) Endl.

## A New Genus of Gramineae.

By

B. de Winter.

*Diandrochloa de Winter*, genus nov. (Eragrosteae), affinis *Eragrosti ciliari* (L.) R. Br. et al., sed ita differt, ligula membranacea, palearum carinae leves vel scabrae, flores staminibus binis.

*Spikelets* laterally compressed, awnless, 2–14-flowered solitary, pedicelled, laterally placed in relation to the rhachis, not exceeding 3.5 mm. in length; rhachilla disarticulating between the florets and above the glumes, glabrous or scabrid, not produced beyond the uppermost floret. *Florets* hermaphrodite, falling entire with a segment of the rhachilla attached; callus very short, rather swollen, truncate, glabrous. *Glumes* persistent, unequal to subequal, membranous, often sub-hyaline, ovate to lanceolate, keeled, apex rounded or acute, one-nerved, nerve prominent and often green. *Lemmas* 0.5–1.5 mm. long, strongly keeled, often depressed between the keels, usually translucent or thinly coriaceous, pallid, greenish or flushed with purple, rounded, emarginate or acute or sometimes somewhat erose, lanceolate to broadly ovate-oblong when flattened, 3-nerved; nerves distinctly raised, very often dark green, glabrous or scabrid, midnerve percurrent, lateral nerves evanescent. *Palea* subequal to the lemma, membranous, broadly-oblong when flattened, 2-keeled nerves strongly developed in the lower part of the keels, evanescent upwards, smooth or scabrid, apex truncate or rounded or 3-lobed. *Lodicules* 2, truncate, tapering downwards. *Stamens* 2, anthers broadly oblong to rotund, 0.2–0.4 mm. long, anther thecae slightly divergent, attached more or less centrally. *Ovary* glabrous, styles terminal, free, stigma plumose. *Caryopsis* obovate-oblong to broadly spindle-shaped, brown, smooth and semitransparent when mature; hilum basal, punctiform; embryo  $\frac{1}{4}$  to nearly  $\frac{1}{2}$  the length of the grain, disc shaped, elliptic-oblong; starch grains simple.

Hygrophylous caespitose annuals or perennials, culms rather soft, hollow, pallid, greenish or purplish, geniculate or erect, few to many-noded, branched or simple; basal sheaths rather loose, pallid-green or pinkish; leafblades linear, flat, occasionally flaccid, tapering to a setaceous point; panicles usually rigid, always much longer than broad, contracted and dense or much branched and divaricate, branches in pseudo-whorls on the strongly developed central axis.

Type species: *Diandrochloa namaquensis* (Nees) de Winter. Species about 7. Natives of the Americas, Australia, Asia and Africa.

It is surprising that this genus has not before been recognised as distinct. Possibly this is because it is represented in most countries by only one or two species. It was not even placed in a distinct section of its own within the genus *Eragrostis* but was always associated with species such as *E. tenella* and *E. ciliaris* which it resembles superficially. *E. tenella* and related species have ciliate ligules and the keels of the palea are fimbriate. These species should not therefore be confused with any of the species of *Diandrochloa*.

According to Dr. J. M. J. de Wet of the Division of Botany the chromosomes of *E. namaquensis* are smaller than those of the other species of *Eragrostis* which he has investigated. The basic number of 10 with the genome of 40 chromosomes is typical of *Eragrostis* and its allies.

The following species of *Eragrostis* should be transferred to the genus *Diandrochloa*: *E. glomerata* (Watt) Dewey (S. & N. America); *E. confertiflora* Black (Australia); *E. japonica* (Thunb.) Trin. (Asia); *E. diarrhena* Steud. (India); *E. diplachnoides* Steud. (Africa and Asia). The synonymy of most of the species listed above is very complicated and in some the status of the taxa is uncertain. For this reason I have refrained from making the combinations for species outside South Africa.

There are only two South African representatives of the genus *Diandrochloa* namely:—

- (a) *Diandrochloa namaquensis* (Nees) de Winter, comb. nov. (*Eragrostis namaquensis* Nees).
- (b) *D. pusilla* (Hack.) de Winter, comb. nov. (*Eragrostis pusilla* Hack.)

They can be distinguished as follows:—

- Spikelets 1·1–1·5 mm. long, 2–4-flowered; lemmas 5–6 mm. long; inflorescence branches with spikelets patently spreading when fully developed.... *D. pusilla*.
- Spikelets 2–3 mm. long, 4–8-flowered; lemmas about 1·0 mm.; inflorescence branches somewhat contracted..... *D. namaquensis*.

#### 1. *D. namaquensis* (Nees) de Winter

*Eragrostis namaquensis* Nees in Linnaea 12, 542 (1838) and Fl. Afr. Austr. 1.408 (1841); Chiov in Ann. Inst. Bot. Roma 8, 63 (1903), do. l.c. 363 (1908); do. in Nuovo Giorn. Bot. Ital. n.s. 19, 423 (1912); de Winter in Grasses and Pastures S. Afr. 182 (1955). *E. namaquensis* var. *robusta* Stapf. in Fl. Cap. 7, 630 (1900). *Catabrosa micranthia* Hochst. ex A. Rich. Tent. Fl. Abyss. 2, 426 (1851) in synonymy.

Annual or subperennial, caespitose, culms erect 15–130 cm. high, hollow, rather soft, glabrous, pallid or greenish, finely striate, 1–6-noded, simple or branched upwards, upper internode exceeding the others and usually long exserted; sheaths striate, lax and slipping from the culms, pallid or flushed with purple, especially towards the base; leafblades linear and tapering to a fine point, flat or somewhat rolled, 5–25 cm. long; up to 5 mm. broad, nerves fine, slightly raised, scabrid; ligule membranous, about 0·5 mm. long. Panicle tightly contracted and linear or open and lax, 10–60 cm. long, erect, branches solitary or approximate and in pseudowhorls, erect and appressed or obliquely spreading, repeatedly divided from the base, subdivisions subcapillary, glabrous or scabrid. Spikelets pedicelled, more or less crowded on the branchlets, elliptic to oblong-elliptic, obtuse, 2–3 mm. long, 4–8-flowered, purplish or greenish-brown, rhachilla disarticulating above the glumes and between the florets, smooth, glabrous. Florets falling entire, hermaphrodite; callus glabrous, slightly obliquely truncate. Glumes unequal to subequal, broadly oblong, obtuse and emarginate, about 0·75 mm. long, 1-nerved, persistent. Lemmas broadly ovate-oblong when flattened, obtuse, emarginate, about 1·0 mm. long, strongly keeled, 3-nerved, slightly depressed between the nerves, nerves smooth. Palea subequal to the lemma, falling with the lemma, keels smooth. Lodicules truncate, cuneate, very small. Stamens 2, anthers 0·3–0·4 mm. long, purple, broadly oblong. Ovary glabrous, styles free, stigmas plumose. Grain obovate-oblong; hilum basal, punctiform; embryo 2/5 of the length of the grain, rotund.

Very widely distributed in Africa, West Tropical Africa, British East Africa and South Tropical Africa. Also found in all the provinces of South Africa including S. West Africa.

This grass prefers moist localities and inhabits river banks and pools. Usually an annual, it is apparently sometimes a weak perennial. It varies tremendously in size, and can be from 15 cm. to over 130 cm. high. The shape of the inflorescence is also variable.

Holotype: Namaqualand, banks of Orange River, Drege 2569 (B; PRE, fragment).



CAPE PROVINCE.—Port St. Johns: Umzimvubu River, *Sidey* 567; Mt. Frere: *Acocks* 13565; Mafeking: *Brueckner* 367; Hay: Langebergen, *Acocks* 8531; fountain at Rietkloof, *Acocks* 8534.

NATAL.—Vryheid: White Umfolosi, *Curson* 148; mountain top, sides of stream, Hlobane, *Johnstone* 423; Hlabisa: Hluhluwe, river banks, *Ward* 2581.

TRANSVAAL.—Potchefstroom: Vaal River, Nooitgedacht, *Louw* 1702; Pretoria: Petronella, *Acocks* 11713; 19 m. N.E. of Premier Mine, *Codd* 2764; Rustenburg: Elandsdraal, *de Winter* 232 B; Ermelo: Morgenson, *Rose Innes* s.n.; Nylstroom: Warmbad, *Schweickerdt* 1786; Potgietersrust: Mosdene, *Galpin* M. 539; Barberton: *Bolus* 9794; Kruger National Park: Numbi, *v. d. Schyff* 2657; Shangani, *v. d. Schyff*, 2820; Punda Maria, *Codd* 5363; Soutpansberg: Tshokoma, *Obermeyer* s.n. Tvl. Mus. No. 31657.

SWAZILAND.—Mbabane: Mbeluzi Falls, near stream, *Compton* 25086.

Bechuanaland.—Makarikari Basin: Nata River, *Van Son*, Tvl. Mus. No. 28614.

SOUTH WEST AFRICA.—Tsoachaubsand Salem, *Dinter* 140; Otjiwarongo: Waterberg, *Vlok* 2240; Stream near Great Waterberg, *Rodin* 2568; Kaokoveld: banks of Kunene, *Story* 5859.

ANGOLA.—*Boss* s.n., Tvl. Mus. No. 36763.

SOUTHERN RHODESIA.—Odzani Valley, *Eyles* 1685; Zambesi River, *Hitchcock* 24190, 24345; Cleveland Dam, *Gilliland* 46; Sabi-Lundi Junction, *Wild* 3339.

NORTHERN RHODESIA.—Matonchi Farm, *Milne Redhead* 2758; Kashitu, *Stohr* 2845, 2844, 2834; River Mekeba, *Milne Redhead* 759; between Livingstone and Kaloma. *Pole Evans* 2797 (4); Broken Hill, *Rogers* 26093.

PORTUGUESE EAST AFRICA.—Tumbini slopes, *Hornby* 3372.

NYASALAND.—Mlanje, Palombe Plain, *Laurence* 376; Benga, Lake Nyasa, *Brass* 17497; Mperere Mission, Chankalamu Dambo, *Jackson* 242.

TANGANYIKA.—Ardai Plain, *Greenway* 7014; Ngudu, Mwanza, *Lewys Lloyd* 16; Lindi, Mikindani, *Schlieben* 6555.

BELGIAN CONGO.—Elizabethville, *Rogers* 26271; *Quarre* 4570, 5530.

ABYSSINIA.—Scholoda Mnt., *Schimper* 406 (fragment).

## 2. *D. pusilla* (Hack.) de Winter.

*Eragrostis pusilla* Hack. in Bull. Herb. Boiss. 4, app. 3, 27 (1896); de Winter in *Grasses and Pastures of South Africa*, 184 (1955).

Caespitose annual up to 30 cm. high, culms erect or slightly geniculate, 1–3 (usually 1)-noded, soft and compressible, pallid, finely striate, simple or branched; sheaths chartaceous, rather loose, pallid, greenish or brown, margins membranous; ligule a membranous rim; leafblades linear, thin, flat, tapering to a fine setaceous point, 4–13 cm. long and up to 0.5 mm. broad, primary nerves 5–7, nerves glabrous or scabrid. *Panicle* densely and divaricately branched, 8–15 cm. long, narrowly elliptic to narrowly oblong in outline, central axis strongly developed and rigid, branches clustered together in pseudowhorls especially lower down or solitary upwards, spreading obliquely or nearly at right angles, repeatedly and finely branched from the base upwards, divisions glabrous or sparsely scabrid. *Spikelets* awnless, more or less broadly oblong 1–1.5 mm. in length, 2–4-flowered, brownish to purplish, pedicelled, pedicels 0.5–1.5 mm.

long; rhachilla disarticulating above the glumes and between the florets, glabrous. *Florets* hermaphrodite, falling with an internode of the rhachilla attached, callus truncate. *Glumes* unequal, lower narrower and shorter than the upper, oblong, one-nerved, obtuse or slightly emarginate, persistent. *Lemmas* broadly oblong, obtuse, emarginate, 0.5–0.6 mm. long, 3-nerved, keeled, depressed between the nerves and membranous, nerves smooth, strongly raised. *Palea* subequal to and falling with the lemma, strongly keeled, keels smooth. *Lodicules* truncate, oblong-cuneate. *Stamens* 2, anthers 0.3–0.4 mm. long, broadly oblong. *Ovary* glabrous, styles free, stigmas plumose. *Caryopsis* obovate-oblong, hilum basal, punctiform, embryo more or less 2/5 the length of the grain.

This is a small delicate and rather decorative hygrophyte, inhabiting the margins of seasonal pools in the subtropical drier areas of the Transvaal, Cape, South West Africa and Bechuanaland and probably also occurring in S. Rhodesia and Angola.

Holotype: Kalahari: in stagnis exsiccatis prope Uugua, May, 1891; *Fleck* 321, (Herb. Hackel, Vienna; fragment in PRE).

CAPE PROVINCE.—Kimberley: Riet Pan, near Riverton, *Reinhardt* 3228; Vryburg: farm Welgelegen, *Pentz* s.n., N.H. No. 14876.

TRANSSVAAL.—Bloemhof: *Louw* 1823; Soutpansberg: Farm Hamilton, *de Winter* & *Codd* 313.

SOUTH WEST AFRICA.—Maltahohe: Farm Urusis, *Kinges* 2548; Gibeon: Fish River Gorge, *V. Trotha* s.n.; Rehoboth: Kalkrand, *de Winter* 3521; Karibib: Farm Otiimbojo East, *Kinges* 3392; Okahandja: Waterberg, *Bradfield* 270; *de Winter* 2807; Okahandja River, *Dinter* 117; Grootfontein: Nosib, *Schoenfelder* S. 878; Nosib road, *Dinter* 7433; Tsumeb, *Dinter* 7432. Okavango: Omuramba Omatoko, *Seiner* 685.

Most of the specimens named *E. namaquensis* Nees var. *uninodis* Hack. are in fact *E. pusilla*. I have not been able to trace a valid publication of the var. *uninodis*.

# The Opening of the Pretoria National Botanic Garden.

By

R. A. Dyer.

After my return in 1934 from the Royal Botanic Gardens, Kew, I cherished the idea of a botanic garden attached to the National Herbarium, Pretoria. Kirstenbosch served the needs of the winter rainfall region of the Union, and a similar institution to serve the summer rainfall area was an obvious necessity. That it should be complementary to the National Herbarium also seemed obvious.

In 1944, towards the end of the war, the idea was given its first airing, in connection with the training of student gardeners, but the time was not propitious. In 1945 the botanical survey section of the Division of Botany was resuscitated with Dr. L. E. Codd in charge. The question of a new botanic garden was then brought into the open and the environs of Pretoria were explored for a suitable area.

At this juncture contact was made with Professor H. B. Davel, then director of the Agricultural Research Institute of the University of Pretoria. Together we inspected the piece of the University farm cut off from the main block by the Silverton and Brummeria roads, which had been found unsuitable for farm experimental purposes owing to its isolation and to the presence of an abundance of *gifblaar*, *Dichapetalum cymosum*. Other areas were considered including a portion of Rietondale Experimental Station, but the University ground was favoured above all others and this project gained the support of the then Minister of Agriculture Mr. J. G. N. Strauss.

The University Council gave formal approval of the development of the area as a botanic garden in June, 1946. Soon afterwards Mr. Jan Erens, head gardener at the Division of Botany, drew up a rough plan of the area, planted the first avenue of experimental trees, supervised the sinking of boreholes and saw to the building of 2 small reservoirs.

The decision in 1947 to purchase the western corner of portion F of Koedoespoort farm 299 proved abortive, owing to a ridiculously high price being placed on the property by the owner.

Mr. Erens was promoted into the Public Works Dept. in 1949 and Mr. A. van der Ende later took over his duties at the Division of Botany at Vredehuis, while Mr. J. Admiraal was appointed to the gardening staff and placed in charge of the new botanic garden.

In 1951 the University Council donated 200 acres on the opposite (south) side of the Brummeria road to the C.S.I.R. for its head office and laboratories. The Division hoped to be treated in similar fashion, but the University Council decided to retain the botanic garden ground under the Agricultural Research Institute.

In 1954, the Bureau of Standards negotiated with the University for the purchase of the botanic garden ground, and interested parties suggested that an area in the Fountains Valley or the Wonderboom Reserve would serve equally well as a botanic

garden. A Commission consisting of Professors W. J. Lutjeharms, A. W. Bayer, R. S. Adamson and N. P. Badenhuizen, reported strongly in favour of the existing project and their recommendation was accepted by the Minister of Agriculture at the time, Mr. S. P. le Roux and the University Council.

The building of a residence on the botanic garden for the gardener in charge was sanctioned in 1955, and was soon completed under the guidance of the P.W.D.

With the support of the Minister, Mr. le Roux, the Secretary for Agriculture, Dr. C. H. Neveling and the Director of Technical Services Dr. M. S. du Toit, we succeeded, in a matter of 13 days, in obtaining Treasury authority to purchase, on 15/10/55, portion G of farm Koedoespoort No. 299, nearly 8 morgen in extent, with northern aspect, to add to the botanic garden.

Progress has been most encouraging and the present Minister of Agriculture (Technical Services) Mr. P. K. le Roux, accompanied by Mrs. le Roux, opened the garden officially on 23rd October, 1958.

By the greatest good fortune, considering the unsettled weather at the time, the morning of the 23rd was perfect for the outdoor ceremony. A Cabinet Meeting called for 11 a.m. on the 23rd, threatened to wreck the opening ceremony, but all obstacles faded away at the last moment.

Mr. le Roux addressed the gathering of about 150 guests, speaking for the first half in Afrikaans and then in English. The text of his address, with a translation, was as follows:—

„Die grond waarop ons vanmore staan is 'n deel van die Pretoria Universiteitsplaas—'n deel van die plaas wat vir die Fakulteit van Landbou opsygesit is. Effens oor die tien jaar gelede het die Universiteitsraad toegestem dat 'n botaniese tuin op hierdie terrein tot stand gebring kon word. Plantkunde, soos u sal begryp, is een van die basiese kursusse in die eerstejaars studiekursus van alle studente wat Landbou loop, dus is daar alle rede om noue samewerking tussen die Fakulteit en die Afdeling Plantkunde te hê.

Dit doen my groot genoë om op hierdie geskiedkundige geleentheid, naamlik die opening van hierdie botaniese tuin, die Rektor—Prof. Rautenbach—en die Universiteitsraad vir hulle vërsiende beleid om hierdie ontwikkeling aan te moedig, te bedank. Die grond is ongeveer 68 morg groot. Deur slegs rond te kyk sal u besef wat 'n uitstekende ligging dit as botaniese tuin het. Dit is maklik bereikbaar daar dit op die nasionale pad van Pretoria na die Oostelike Transvaal en die Kruger Wildtuin geleë is. Al hoe meer oorsese besoekers sal langs hierdie roete reis en hierdie vertoonvenster van ons Suid-Afrikaanse flora sien. Dit sal gedurig in die oog van die publiek wees.

Daar is noordelike en suidelike hange; daar is 'n groot golwende gebied wat uit diep sanderige grond bestaan, en daar is hierdie mooi koppie agter my wat die hele terrein oorheers en vanwaar 'n groot deel van Pretoria sigbaar is. 'n Mens kan ook na die imposante reeks geboue wat deur die Wetenskaplike en Nywerheids Navorsingsraad oorkant die pad opgerig is, tuur, en peins omtrent wat alles in hulle gedoen word. Ja, hierdie is waarlik 'n stimulerende omgewing en ons kan verwag dat hierdie tuin in die jare wat voorlê iets om op trots te wees sal word.

Plantkunde in die breë sin van die woord ken geen grens tussen sulke onderwerpe soos Tuinbou, Plantsiektekunde, Weidingsnavorsing, Veldbeheer, Plantfisiologie en Planteteelt nie. Plantkunde dien hulle almal. Wanneer 'n nuwe gebied ontgin word is een van ons eerste pligte om 'n opname van die inheemse plantegroei te maak. Die samestelling van die natuurlike onbeskadigde veld toon beste aan hoe die land gebruik moet word om die maksimum landboukundige opbrengs daaruit te verkry.



My vriende wat boer is sterk bewus van die aanhoudende pogings van die Departement om die land meer bekwaam te gebruik. Hulle is bewus van die verslag oor hierdie onderwerp wat deur die Afdeling Ekonomie en Markte uitgegee is. Veldwerkers van die Afdeling Plantkunde het 'n belangrike bydrae tot hierdie werk gelewer deur veldtipes en hulle verspreiding af te baken.

Die boer self moet sy veld ken. Hy moet soveel as moontlik van die afsonderlike plante, wat sy veld vorm ken. Hy moet die goeie voerplante, wat aangemoedig en teen oorbeweiing beskerm moet word, ken. Hy moet ook die giftige plante, wat gedurig 'n bedreiging vir sy vee is, ken. Die Afdeling Plantkunde het baie inligting omtrent hierdie onderwerpe versamel, maar sal in hierdie ontsaglik studieveld nooit alles kan weet nie. Ons kennis is nooit volledig nie. Plante uit die veld sal in hierdie tuin vir verdere studie gekweek word en die inligting aldus verkry sal soos in die verlede, vir die boeregemeenskap en algemene publiek, beide in die Unie en oorsee, beskikbaar gestel word.

Die geskiedenis van Landbou in die Unie gaan terug na die aankoms van Jan van Riebeeck aan die Kaap in 1652. Een van sy eerste pligte was om 'n tuin vir die kweek van groente, om handelsskepe van die Hollands-Oos-Indiese Kompanjie daarmee te voorsien, tot stand te bring. Die geskiedenis van die Landbou in Transvaal dek egter 'n baie korter tydperk en begin kort voor 1900. Sommige van die vroeë gebeurtenisse is van algemene belang en toepaslik op hierdie geleentheid. In 1896 het die Volksraad 'n veearts, Arnold Theiler, aangestel om die Runderpes, wat toe gewoed het, te bestry. 'n Plantkundige, Burt Davy, is in 1903 aangestel, dus het die Departement van Landbou in die Transvaal met die aanstelling van 'n veearts en 'n plantkundige begin. Die plig van die plantkundige was om in die veld uit te gaan, boere te ontmoet, en die landboubehoefte van die verskillende streke te bespreek, om die voerplante van die natuurlike veld te bestudeer, sowel as die giftige plante, skadelike onkruid, ens. Daarby moes hy verteenwoordigende versameling van hierdie plante wat die kern van 'n herbarium sou vorm, bewaar.

'n Plantsiektekundige is in 1905 tot die span gevoeg om graansiektes te bestudeer.

Na Unie was die ontwikkeling vinniger en is die staf aansienlik uitgebrei. By die funksies van die Afdeling Plantkunde en Plantsiektekunde is Tuinbou, Akkerbou, Weiding, Insektekunde, Grondbewaring en Uitbreiding gevoeg, en die hele organisasie het die Afdeling van Plantnywerheid geword. By die hoofkwartier te Vrede Huis was slegs 'n klein botaniese tuin en bykomstige proefstasies om inheemse en ingevoerde plante te ontvang en te toets ten opsigte van hulle landboukundige moontlikhede, is opgerig.

Die skepper van die Afdeling van Plantnywerheid, Dr. I. B. Pole Evans het in 1939 op pensioen afgetree, en dit is toe besluit dat die leiding van die verskillende lyne van navorsing wat hy tot stand gebring het onder onafhanklike Hoofde van Afdelings voortgeset wou word. Op die manier het Tuinbou, Akkerbou en Weiding, Insektekunde, Grondbewaring en Uitbreiding afgeskei en die Plantkunde en Plantsiektekunde seksies was weer op hulle eie. 'n Tydjie later het Plantsiektekunde ook mondig geword en 'n Afdeling op sy eie geword.

Nadat hy hierdie satelliete met welslae afgevuur het, kon die Afdeling Plantkunde sy aandag skenk aan 'n meer eng botaniese navorsingsveld, en so is dit teweeggebring dat plantkundiges in die Nasionale Herbarium, wat grootliks besiggehou word met die opname en klassifikasie van ons inheemse flora, gevoel het dat 'n botaniese tuin, wat die naam waardig sou wees, waarin lewende plante gekweek en waargeneem kan word—'n tuin waarin die moontlikhede van elke soort afsonderlik bestudeer kan word—noodsaaklik geword het. Tegelykertyd sou dit 'n opvoedingsentrum en skoonheids-oord word.

Op hierdie tydstip is die verbond tussen die Afdeling Plantkunde en die Universiteit van Pretoria, waarna ek in die begin verwys het, gemaak.

Sedert die vroegste tye is plante in tuine versorg. Die vroegste tuine het hoofsaaklik te doen gehad met die kweek van geneeskragtige kruie en was werklik die eerste wetenskaplike plantkundige inrigtings. Selfs vandag, hoewel daar so 'n menigte van die nuwe sintetiese medisynes is, is daar nog 'n diep belangstelling in navorsing van die wêreld se plantegroei met die oog op die ontdekking van nuwe medisynes of nuwe bronne van bekende samestellings. Suid-Afrika dra reeds 'n belangrike deel by deur die uitvoer van aalwyn, boegoeolie en diosgenin, wat uit *Dioscoria* verkry word vir die vervaardiging van cortisone, om slegs drie voorbeelde te noem. Op die huidige tydstip is daar 'n skema wat deur handelsbelange in Amerika ondersteun word, om 'n pos vir 'n Afrikanerskeikundige wat die plantegroei van die Unie meer intensief as ooit tevore sal bestudeer, te skep. Die persoon aan wie die pos geskenk word sal van beide die W.N.N.R. en die Afdeling Plantkunde leiding ontvang, en in hierdie tuin waarin ons vanmore saamgekom het, sal plante deur hom versamel en gekweek word.

Wanneer ons die taamlik onlangse geskiedenis van botaniese tuine beskou vind ons dat baie van hulle dwarsdeur die wêreld 'n belangrike rol in die toets en verspreiding van plante wat van ekonomiese belang is, gespeel het. Daar is die beroemde geval van die plantkundige wat toevallig 'n paar sade van die rubberboom in sy natuurlike omgewing in Suid-Amerika versamel het, en hulle na Kew Botaniese Tuin in Engeland gestuur het. Die jong rubberbome wat daaruit gespruit het is toe na die Singapoer Botaniese Tuin gestuur, en uit hierdie klein begin is 'n industrie met 'n geweldige waarde vir die mens, en bepaald baie miljoen pond werd, opgerig. Botaniese Tuine van die wêreld het 'n ewe belangrike rol in die ontwikkeling en uitbreiding van die katoen, kiena en tee-industriële gehad, en uit Australië het ons die voorbeeld van die uitgebreide koringnywerheid wat ontstaan het vanuit 'n paar sade wat na die Sydney Botaniese Tuin ingevoer is. Ek kan u ook as 'n voorbeeld noem een van ons eie veldgewasse, wat 'n belangrike plek in die landbou buite ons grense ingeneem het, deur die toedoen van wyle Dr. Maria Wilman wie op die flora van Griekwaland-Wes gewerk het. Dr. Wilman het saad van een van ons gewone veldgrasse—een wat destyds geen groot naam in die Unie gehad het nie—na Amerika gestuur. Hierdie gras, *Eragrostis curvula*, het spoedig in die Amerikaanse landbou in die guns geraak, met die gevolg dat dit vandag as weiding en grondverbetering oor groot landstreke gesaai word, en in die algemeen die “Wilman Love Grass” genoem word. Die Amerikaners het reeds verbeterde tipes daarvan by hulle navorsingstasies voorgebring. Die waarde van hierdie gras word nou ook in die Unie meer besef en in die Griekwaland-Oos distrik alleen is reeds meer as 10,000 akker binne die afgelope 8 jaar met Love Grass beplant. Die plantkundige in sy Botaniese tuin was bepaald al in menige ekonomiese belangrike landboukundige sake betrokke.

Ek het met opset u aandag op hierdie paar voorbeelde gevestig, om u te herinner hoe nou die landbou en ons alledaagse voorspoed met plantkunde verbonde is. Sedert die tydperk toe dit slegs van mediese belang was, het die funksies van 'n botaniese tuin eger geleidelik verander. Dit is nog 'n setel van opvoeding en geleerdheid, maar geleidelik het die estetiese aspek na vore getree. Laasgenoemde is ook van groot belang wanneer ons sy invloed op die opbou van ons nasionale kultuur oorweeg. 'n Opgevoede gemeenskap moet besef dat dit sy plig is om op intelligente wyse in die flora van sy land belang te stel. En wat is daar in ons flora om 'n gevoel van nasionale trots aan te wakker?

In die eerste plek kan ons daarop aanspraak maak dat die Unie van Suid-Afrika, in verhouding tot sy grootte een van die rykste floras in die wêreld het. Hier word oor die 20,000 soorte plante gevind. Om 'n paar statistieke te noem het ons ongeveer 500 soorte Erica, 300 soorte Protea en sy verwante, oor 880 soorte grasse, en heelwat meer as 1,500 soorte vygies en ander vetplante.

Die versamel en kweek van vetplante, wat vanaf die vroegste dae toe ontdekkingsreise in die Kaap gedoen is, populêr was, is vandag nog 'n stokperdjie waarin baie spesialiste verdiep is. Daar is 'n aanhoudende belangstelling en handel in hierdie groep, waarin die eindelose verskeidenheid van vorm en kleur altyd 'n bron van bewondering is. Daar is die Aalwyne, die vensterplante wat half begrawe is in harde grond, die klipagtige plante wat op die oppervlakte groei en so harmonies met hulle omgewing saamsmelt dat hulle besonder moeilik is om raak te sien, en 'n menigte ander eienaardige vorms. Nêrens in die wêreld is daar 'n vetplante-flora so ryk soos ons s'n nie.

In sommige droë dele van Amerika is daar 'n groot verskeidenheid cacti, 'n groep wat in die Unie afwesig is; maar die vetplant-flora van die Unie is nie alleen geweldig ryk in soorte nie maar het ook verteenwoordigers in 'n aantal heeltemal onverwante families waarin parallelle ewolusie plaasgevind het.

Maar dit is nie al nie. Die Unie het 'n aansienlike bydrae tot botaniese tuine en tuinbou dwarsdeur die wêreld gelever, vanuit die seldsame en pragtige flora waarmee die natuur ons so mildelik bedeel het.

Selfs voor die eerste blanke nedersetting aan die Kaap ongeveer 300 jaar gelede, het daar reeds 'n klein handel in Kaapse plante met 'n aantal koninklike tuine in Europa ontstaan. Matrose wat in die tuinbou belanggestel het, het saad en bolle versamel wanneer hulle tydelik geland het. Hoewel van Riebeeck die eerste nedersetters aan die Kaap streng beveel het om nie verder as die Skiereiland te reis nie, is hierdie perke spoedig oorskry. Later het die twee Goewerneys, Simon en Adriaan van der Stel, vader en seun, spesiale ontdekkingsreise na die binneland georganiseer om onder andere plante en saad te versamel om die beroemde tuine van Holland te verryk.

Gedurende die agtiende eeu was daar 'n standvastige vooruitgang in die invoer van Suid-Afrikaanse plante in Europa totdat, aan die einde van die eeu, dit gesê kon word dat ons *Ericas*, *Proteas*, *Stapelias* en baie bolplante byna die kweekhuise van nie alleen Holland, maar ook van Engeland, Oostenryk, Swede, Italië en Frankryk oorheers het. Tussen die besitters van tuine was daar skerp mededinging om die rykste versameling uitheemse plante te mag besit. Die Kaapse flora was 'n ontsaglike ryk bron om uit te put.

Gedurende die neëntiende eeu het die ambisie om nuwighede te kweek bedaar, en ons Flora het gedeeltelik sy aantrekkingskrag verloor, egter nie voor sulke plante soos *Agapanthus*, *Nerine*, *Gladiolus*, *Pelargonium* en vuurpyle, varkblomme en selfs sommige van die Namakwalandse madeliefies, blywende plek in die tuine van Europa en die Nuwe Wêreld ingeneem het nie. Terwyl hierdie Suid-Afrikaanse plante oorsee makgemaak is, het hulle die aandag van plantekwekers getrek, met verreikende tuinboukundige gevolge. Onder die kruisings wat eerste in guns geraak het, was die *Pelargoniums*—gewoonlik onder die naam *Geranium* bekend—wat tot vandag so uitgebreid in tuine gekweek word. U sal u herinner dat die *Geranium* Vereniging van Britanje onlangs aan die Unieregering 'n versameling van die beste moderne kruisings geskenk het, as 'n blyk van waardering aan die land van hulle herkoms. Hierdie versameling is nou in bewaring van die Afdeling Tuinbou.

Dan is daar die rooi Barbertonse Madeliefie, wat deur seleksie en kruising 'n byna eindelose verskeidenheid van kleure en dubbelvorms voortgebring het, en wat die besonder goeie hoedanigheid het dat dit so lank in water kan hou. Om die waarheid te sê is daar maar min van ons gekweekte blomme wat hulle oorspronklike vorm behou het. Besoekers aan openbare tuine oorsee dink nie eers om navraag te doen oor die land van oorsprong van die vele tuinboukundige wondere nie.

Is dit dus nie paslik dat ons ons eie flora behoort te eer nie; dit in sy natuurlike toestand moet bestudeer, dit in hierdie botaniese tuin moet kweek en bewaar sodat almal dit kan sien en waardeer nie? Hier sal geen plek vir uitheemse plante wees nie.



Sonder twyfel is daar in die teenwoordige eeu dwarsdeur die Unie 'n al gemene oplewing van belangstelling in die kweek van ons inheemse flora. Groot stappe vooruit is gemaak in die openbare tuine van sommige van die groter en heelparty van die kleiner dorpe. Uitgebreide gebiede is opsygesit vir die bewaring van aantreklike en interessante soorte. Dit werk alles ten goede en die neiging behoort soveel moontlik aangemoedig te word, maar uit die aard van die saak is die wetenskaplike toenadering afwesig of slegs tot 'n beperkte mate in ag geneem. Slegs inrigtings soos die Afdeling Plantkunde met sy staf bestaande uit opgeleide plantkundiges en tuiniers kan wetenskaplike studie met die kweek van plante verenig.

Die Nasionale Botaniese Tuin te Kirstenbosch, wat in 1913 tot stand gekom het, het 'n soortgelyke organisasie—'n tuin en 'n opgeleide plantkundige staf. Om die waarheid te sê word dwarsdeur die wêreld die kombinasie van 'n botaniese tuin met 'n herbarium en biblioteek erken as die ideale organisasie om plantkunde as wetenskap te bevorder.

Die Nasionale Botaniese Tuin te Kirstenbosch het tans 'n wêreldwye reputasie deur sy pragtige omgewing en groot natuurlike skoonheid. Sy reputasie is onlangs verder bevorder deur die toekening van 'n goue medalje op 'n internasionale blommeskou in New York vir 'n versameling van Suid-Afrikaanse blomme wat hoofsaaklik uit Proteas bestaan het. Kirstenbosch kan egter nie 'n beeld gee van die flora van die hele Unie nie. Geen enkele inrigting sou dit kon doen nie.

Soos u almal weet word die Unie volgens klimaat in 'n oorwegende winterreënvalstreek en 'n oorwegende somerreënvalstreek verdeel, met 'n betreklik klein streek met reën dwarsdeur die jaar in die George-Knysna gebied. Soos te begryp is die flora van die twee hoofgebiede baie verskillend. Kirstenbosch, wat 'n hoë winterreënval geniet, is dus die mees gepaste plek om die flora van daardie gebied te bestudeer. Die plantegroei van die somerreënvalstreek is nie daar tuis nie, en dit is hierdie afdeling wat die meeste aandag in hierdie nasionale Botaniese Tuin sal geniet. Die Afdeling Plantkunde wil egter nie sy ambisie verswyg om ook sukses met sommige van die Kaapse plante te behaal nie, en aan my is meegedeel dat hierdie plan bevorder word deur Mev. Vogts, wat self vanmore hier aanwesig is, en self in Pretoria sukses daarmee behaal het na vroeëre ondervinding aan die Kaap.

Die gedagte het seker al by meeste van u verrys dat die ontwikkeling van 'n botaniese tuin met die bou van 'n nasie vergelyk kan word. Die stigters het hulle ideale en strewe; hulle lê die fondament, maar sien selde hulle arbeid tot volle bloei kom. Vandag lê ons dus spreekwoordelik die hoeksteen van 'n gebou wat baie jare sal neem om sy volle grootte te bereik. As simbool van die strewe van die Afdeling Plantkunde is ek gevra om 'n inheemse boom as aandenking aan hierdie geleentheid te plant. Die groei en ontwikkeling van die boom wat jaar na jaar in grootte en skoonheid sal toeneem, sal 'n inspirasie wees vir latere geslagte van tuiniers en plantkundiges. En met hierdie vooruitsig waarin ons ten volle vertrou het doen dit my genoeë om hierdie Nasionale Botaniese Tuin oop te verklaar. Ons sal nou voortgaan om die boom te plant.”

“The ground we are standing on this morning is part of the Pretoria University farm—part of the farm set aside for the Faculty of Agriculture. It is now a little over ten years ago that the University Council agreed to the establishment of a botanic garden on this site. Botany, it will be appreciated, is one of the basic courses in the first year curriculum of all students taking Agriculture, so there is every reason why there should be close collaboration between the Faculty and the Division of Botany.

It gives me great pleasure on this historic occasion of the official opening of this botanic garden to thank the Rector—Professor Rautenbach—and the Council of the University for their far sighted policy in fostering this development. The area is approximately 68 morgen in extent. You have only to glance round to appreciate what an



excellent site it is for a botanic garden. It is readily accessible. It is on the national road from Pretoria to the eastern Transvaal and the Kruger National Park. Along this route more and more overseas visitors will travel and see this display window of our indigenous flora. It will be constantly in the public eye.

In this garden there are north and south facing slopes; there is a large undulating area of deep sandy soil, and there is this fine koppie behind me which dominates the whole site and from which one can survey a wide expanse of Pretoria. Or one can gaze and ponder about what goes on across the road in that imposing array of buildings erected by the Council for Scientific and Industrial Research. Yes, this is a truly stimulating environment and we can expect this garden to become a place of pride in years to come.

Botany in its broad sense knows no boundary between such subjects as Horticulture, Plant Pathology, Pasture Research, Veld Management, Plant Physiology and Plant Breeding. Botany serves them all. When a new territory is opened up one of the first duties is to take stock of the wealth of the indigenous vegetation. It is the composition of the natural undamaged veld which affords the best indication of how the land should be utilised for the maximum agricultural output.

My farming friends are well aware of the continuous efforts of the Department for more efficient land utilisation. They are aware of the report on this subject by the Division of Economics and Markets. The field officers of the Division of Botany played an important part in this project in demarcating veld types and their distribution.

The farmer himself must know his veld. He must know as many as possible of the individual plants which go to make up his veld. He must know the good fodder plants, those to be encouraged and protected against overgrazing. He must know also the poisonous plants which are a constant menace to his stock. The Division of Botany has a good store of information on these subjects but can never find out all there is to know in such a vast field of study. Our knowledge is never complete. Plants from the veld will be introduced into this garden for further study and the information obtained, will, as in the past, be made available to the farming community and general public both in the Union and overseas.

The history of Agriculture in the Union dates back to the arrival of Jan van Riebeeck at the Cape in 1652. One of his first duties was to establish a garden for the cultivation of vegetables to supply trading vessels of the Dutch East India Company on their way to and from the East Indies. The History of Agriculture in the Transvaal, however, covers a very much shorter period and begins shortly before 1900. Some of the early events are of general interest and relevant to the present occasion. In 1896 the Volksraad appointed a veterinarian, Arnold Theiler, to combat the scourge of Rinderpest which was then raging. A botanist, Burt Davy, was appointed in 1903. Thus it was that the Department of Agriculture in the Transvaal had its beginning in the appointment of a veterinarian and a botanist. The duty of the botanist was to go out into the veld, to meet farmers and discuss the agricultural needs of the different areas, to study the fodder plants of the natural veld, the poisonous plants, noxious weeds and any plant which might have some economic value. In addition he had to preserve for permanent record representative collections of these plants as the nucleus of a herbarium.

A Plant Pathologist was added to the team in 1905 to study cereal diseases.

After Union there was more rapid development and considerable staff expansion. To the functions of the Division of Botany and Plant Pathology were added Horticulture, Crops, Pastures, Entomology, Soil Conservation and Extension, and the whole organisation became the Division of Plant Industry. There was only a small botanical garden

at the headquarters at Vrede Huis and additional experimental stations were established to receive indigenous and introduced plants where they could be tested for their agricultural potentialities.

The Architect of the Division of Plant Industry, Dr. I. B. Pole Evans, retired on pension in 1939, when it was decided that the direction of the several lines of research which he had initiated should be placed under independent Chiefs of Divisions. Thus Horticulture, Crops and Pastures, Entomology, Soil Conservation and Extension hived off leaving the Sections of Botany and Plant Pathology on their own again. Some-time later Plant Pathology also attained its majority and became a fully fledged Division.

Having successfully launched these important satellites the Division of Botany was set to concentrate on a more strictly botanical field of research, and so it was that botanists in the National Herbarium, who are largely occupied with the stocktaking and classification of our indigenous flora, felt the need of a botanical garden, worthy of the name, in which to grow and observe plants in their living state—a garden in which to study the potentialities of each individual species. In would be at the same time an educational centre and a place of beauty.

It was at this stage that the alliance was made between the Division of Botany and the University of Pretoria to which I referred at the outset.

From time immemorial plants have been cared for in gardens. The earliest gardens were concerned mainly with the cultivation of herbs with medicinal properties and were in fact the first scientific botanical institutions. Yet even today, with the spate of new synthetic drugs there is still an intense interest in the exploration of the vegetation of the world for the discovery of new drugs or new sources of known compounds. South Africa is already making valuable contributions by the export of “aloes”, “buchu oil”, diosgenin, from *Dioscorea* for the manufacture of cortisone, to mention only three examples. There is now on foot a scheme sponsored by commercial interests in America to create a Fellowship for a South African to explore the chemical properties of the flora of the Union more intensively than ever before. The holder of the Fellowship will receive direction from both the C.S.I.R. and the Division of Botany, and this garden, in which we are gathered this morning, will receive any plant material which shows promise of beneficial properties.

If we look into the fairly recent history of botanical gardens we find that many of them throughout the world have played an important part in the trial and distribution of plants of economic importance. There is the famous case of the botanist casually collecting a few seeds of the rubber tree in its wild habitat in South America and sending them to the Kew Botanic Gardens in England. The resulting young rubber trees were then forwarded to the Singapore Botanic Gardens, from which small beginning an industry of immense value to mankind, and certainly one worth many millions of pounds, has been established. Botanical Gardens of the world played an equally important part in the development and expansion of the cotton, quinine and tea industries, and from Australia we have the example of the extensive wheat industry being founded on a few seeds introduced into the Sydney Botanic Gardens.

I can give you an example also of one of our veld plants gaining a place of importance in agriculture beyond our borders through the action of the late Dr. Maria Wilman who worked on the flora of Griqualand West. Dr. Wilman sent seed of one of our ordinary veld grasses—one with no great reputation in the Union at the time—to America. This grass, *Eragrostis curvula*, soon found favour in American agriculture, with the result that today it is sown as a pasture and soil improver over vast areas, and is commonly referred to as the ‘Wilman Love Grass’. The Americans have, in fact, already produced improved strains at their experimental stations. The value of

the grass is now appreciated more in the Union too, and in the Griqualand East district alone over 10,000 acres have been planted with Love Grass within the last 8 years. The botanist in his botanical garden has certainly had a finger in many a rich agricultural pie.

I have purposely drawn your attention to these few examples to remind you how intimately Agriculture and our every day welfare have been linked with the subject of botany. The functions of botanical gardens have, however, undergone a gradual change since the days of the purely medicinal concept. It is still a seat of learning and education and gradually the aesthetic aspect has gained prominence. This is also of great importance when we weigh its influence in the building up of a national culture. An educated community must recognise that it is its duty to take an intelligent interest in the flora of the country in which it lives.

And what have we in this flora of ours to inspire a national pride?

For a start we can claim that, for its size the Union of South Africa has one of the richest floras in the world. It supports nearly 20,000 species. To mention a few statistics we have about 500 species of *Erica*, 300 species of *Protea* and its allies, over 800 species of grass and well over 1,500 species of vygies and other succulents.

The collection and cultivation of succulents, which was popular from the earliest days of exploration at the Cape, is still an absorbing hobby for many specialists. There persists a steady interest and trade in this group in which the infinite variety of form and colour is a continual source of wonder.—There are the Aloes, the window plants half buried in hard ground, the stone-like plants growing on the surface and blending so harmoniously with their surroundings that they are extremely difficult to detect, and a host of other curious forms. Nowhere in the world can our succulent flora be matched for its richness.

Some arid areas of the Americas boast a great variety of Cacti which are absent from the Union, but the succulent flora of the Union is not only immensely rich in species but is represented in a number of unrelated families in which there has been parallel evolution.

But this is by no means all. The Union has contributed handsomely to botanical gardens and horticulture throughout the world from the rare and beautiful flora with which nature has so lavishly endowed us.

Even before the first European settlement at the Cape about 300 years ago, there had developed a small traffic in Cape plants to several royal gardens of Europe. Sailors with an interest in horticulture had gathered seed and bulbs during temporary landings. And although the first settlers at the Cape were given strict instructions by van Riebeeck to confine their wanderings to the Peninsula, it was not long before these bounds were broken. Later the two Governors, Simon and Adriaan van der Stel, father and son, organised special expeditions into the interior in order, among other things, to collect plants and seed to enrich the famous gardens of Holland.

Steady progress with the introduction of South African plants to Europe was made during the 18th century, until towards the end of the century, our *Ericas*, *Proteas*, *Stapelias* and many bulbous plants, may be said almost to have dominated the greenhouses, not only of Holland but of England, Austria, Sweden, Italy and France. There was great rivalry among the owners of gardens to claim the richest collection of rare plants from foreign lands. The Cape Flora was a tremendously rich reservoir from which to draw.



During the 19th Century the ambition for novelty subsided and our Flora lost some of its attraction; not, however, before such subjects as *Agapanthus*, *Nerine*, *Gladiolus*, *Pelargonium*, the red hot pokers, *Arum* lilies, and even some of the Namaqualand daisies, had earned for themselves a permanent place in the gardens of Europe and the New World. During their domestication overseas these South African plants attracted the attention of plant breeders with far reaching horticultural results. Among the earliest hybrids to gain favour were the *Pelargoniums*—popularly referred to as *Geraniums*—which are so extensively used to this day. It will be recalled that the *Geranium Society* of Great Britain quite recently presented the Union Government with a collection of the best modern hybrids as a token of gratitude to the Country of their origin. This collection is now under the care of the Division of Horticulture.

Then there is the red *Barberton* daisy, which by selection and hybridisation has yielded an almost endless variety of shades and double forms, whose lasting quality as a cut flower is a special asset. There are in fact very few of our cultivated flowers which have retained their original purity. Visitors to public gardens overseas take so many of these wonders for granted that few pause to enquire about the country of origin.

Is it not fitting therefore that we should honour our own flora, study it in its natural condition, cultivate and preserve it in this botanical garden for all to see and appreciate? There will be no place here for exotics.

There is no doubt that the present century has seen a general awakening of interest in the cultivation of our indigenous flora throughout the Union. Rapid strides have been made in the public gardens of some of the larger and several of the smaller towns. Extensive areas have been set aside for the preservation of attractive and interesting species. This is all to the good and the trend should be encouraged as much as possible; but in the nature of these undertakings the scientific aspects are absent or, at best, observed only to a limited degree. It is only institutions such as the Division of Botany with a staff of trained botanists and gardeners that can combine scientific study with the art of cultivation.

The National Botanic Garden of Kirstenbosch established in 1913 has a similar organisation—a garden and a trained botanical staff. In fact throughout the world the combination of a botanical garden with a herbarium and library is recognised as the ideal organisation for the advancement of botanical science.

The National Botanic Garden at Kirstenbosch has earned for itself a world-wide reputation for its magnificent setting and its great natural beauty. Its reputation was enhanced still further recently by the winning of a gold medal award at an international wild flower show in New York for a collection of South African flowers consisting mostly of *Proteas*. But Kirstenbosch cannot feature the whole of the Union's flora. No single institution could do so.

As you all know the Union is divided climatically into a predominantly winter rainfall region and a predominantly summer rainfall region, with a relatively small region of equal proportions of winter and summer rainfall in the George-Knysna area. As one could guess, the flora associated with the 2 main regions is distinctive. Thus Kirstenbosch, which enjoys a high winter rainfall, is suited best for the study of the flora of that region. The summer rainfall flora is not at home there and it is this section which will receive most attention in this Botanic Garden in Pretoria. The Division of Botany does not disguise its ambition, however, to achieve success with some of the Cape specialities, and I have been told that this project is fostered by Mrs. Vogts, who is present this morning, and has herself had success in Pretoria after earlier experience at the Cape.



It must have occurred to most of you that the development of a botanical garden has a likeness to the building of a nation. The founders have their ideals and aspirations; they set the foundation, but rarely see the full harvest of their labours. Thus today, we are, so to speak, laying the foundation stone of an edifice which will take many years to reach maturity. As a symbol of the ambition of the Division of Botany I have been asked to plant an indigenous tree to commemorate this occasion. The growth and development of the tree—year by year gaining in stature and beauty—is to be an inspiration to future generations of gardeners and botanists. And on this note of confident expectation, I have pleasure in declaring this national Botanic Garden open. We shall now proceed to the planting of the tree.”

One of the staff said later: While we entertained our guests to tea some phrases of the Minister’s address seemed to linger on the air— a botanical garden worthy of the name, in which to grow and observe our plants in their living state—in which to study the potentialities of each individual species—a garden that would be at the same time an educational centre and a place of beauty.

Now we look forward to the building of a new herbarium on a site within the new botanic garden. It is sorely needed.

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The title Pretoria National Botanic Garden—Pretoria Nasionale Botaniese Tuin—was approved by the Council of the Pretoria University and by the Department of Agriculture (Technical Services) in 1959.



# Notes on some South African species of the Genus *Euclea*

By

B. de Winter.

*EUCLEA CRISPA*, *E. LANCEOLATA*, *E. OVATA* AND SOME HYBRIDS.

The fact that *Celastrus crispus* Thunb. represents a species of *Euclea* was realised by Sonder who states in a note in Harvey & Sonder Fl. Cap. 1: 461 (1859-60) "*Celastrus crispus* Thunb. = *Euclea* (Ebenac)". Later this was taken up by Guerke in Pflanzenfamilien 4, 1: 158 (1891) who credited the combination to Sonder.

Under the modern Rules of Botanical Nomenclature a new combination is only valid if the combination is actually made, hence in the present case, Guerke not Sonder is the effective author.

Guerke regarded *Celastrus crispus* as representing the same species as *E. ovata* Burchell, Pflanzenfam. 4, 1: 158 (1891). When the type specimen of *C. crispus* was examined by me, it was found to agree more closely with the type of *E. lanceolata* E. Mey. ex DC. However, Hiern, in the Fl. Cap., and later Sim, in his Forest Flora of Cape Col. p. 262, noted that *E. lanceolata* and *E. ovata* cannot easily be distinguished. I have failed to find sufficient difference to justify keeping them as distinct species.

I regard *E. lanceolata* to be a synonym of *E. crispa* and *E. ovata* a variety of *E. crispa*.

***Euclea crispa* (Thunb.) Sond. ex Guerke**, aggregate species.

(a) var. ***crispa***.

*E. crispa* (Thunb.) Sond. ex Guerke in Pflanzenfam. 4, 1: 158 (1891). Type: Cape, Thunberg s.n. *E. lanceolata* E. Mey ex DC. Prodr. 8: 217 (1844); Hiern in F.C. 4, 1: 467 (1906). Type: Klipplaat River, Drege s.n.

*Celastrus crispus* Thunb. in Hoffm. Phytogr. Blätt 1: 23 (1803).

(b) var. ***ovata* (Burch) de Winter** comb. et stat. nov.

*E. ovata* Burch. Trav. S. Afr. 1: 387 (1822); Hiern in F.C. 4, 1: 468 (1906). Type: Hay, Sluipslang, Burchell 1706.

When studying the var. *ovata* it was found that the leaves of some specimens are indistinguishable from the leaves of *E. coriacea*, a species very different in its floral characteristics. The undulate margin, indumentum and acute apex of the leaves of var. *ovata* are reminiscent of *E. coriacea*, and the area of distribution is so situated that the idea that var. *ovata* originated due to hybridization between *E. coriacea* and *E. crispa* presents itself. The floral structure, however, offers little evidence for the suggestion since the flowers of the var. *ovata* have deeply cleft corollas, quite unlike those of *E. coriacea*, in which the corollas are only very shallowly lobed. One could assume that the gene for a deeply cleft corolla is dominant. In some forms of *Euclea natalensis*, which, on the evidence available, can only be regarded as the result of hybridization between *E. natalensis* and *E. tomentosa*, the same obstacle presents

itself. Here again the acceptance of the deeply lobed corolla as being controlled by a dominant gene will give a reasonable explanation of the absence of plants with intermediate floral characteristics. Should the presence of this dominant gene be accepted, it is clear that the var. *ovata* could have acquired some of the leaf characteristics of *E. coriacea* by introgressive hybridization, while the flowers have remained more or less unaltered and resemble those of *E. crispa*. *E. coriacea* has on the other hand apparently remained unchanged, a fact which could be regarded as evidence against hybridization having taken place. It is significant, however, that the studies of Stebbins and others on hybridization and its effects (Variation and Evolution in Plants 1950) offer examples which agree almost in detail with the case discussed here (Chap. 7: 262-265).

On the importance of the environment for the success of hybridization I quote Stebbins: "Hybridization between well-established and well-adapted species in a stable environment will have no significant outcome or will be detrimental to the species populations. But if the crossing occurs under rapidly changing conditions or in a region which offers new habitats to the segregating offspring, many of these segregates may survive and contribute to a greater or lesser degree to the evolutionary progress of the group concerned".

According to Acocks in Veld Types of S. Afr., Bot. Survey Mem. No. 28, the Karroo vegetation has advanced considerably eastward since the advent of man in the southern tip of Africa. When the maps drawn up by Acocks depicting conditions in 1400 A.D. and 1950 A.D. are superimposed, the supposed original boundary between Karroo and tropical grassveld and the actual boundary in 1950, enclose an area which agrees in remarkable detail with the area of distribution of var. *ovata*. It can be inferred that conditions in this area, which can be regarded as transitional, are unstable and offer a range of new habitats. On the other hand it seems unlikely that the var. *ovata* is of very recent origin, which suggests that the unstable conditions of this area go back to much earlier times than estimated by Acocks.

Another possibility is that the var. *ovata* has become better adapted to arid conditions than either of its parents, due to a recombination of characters. In this case the distribution may be mainly determined by rainfall. The distribution of rainfall, however, does not agree nearly as closely as the former with the area of distribution of the var. *ovata*, nor does geological data combined with rainfall offer a better solution.

#### EUCLEA SCHIMPERI, E. DAPHNOIDES AND E. MACROPHYLLA.

An examination of the Abyssinian species *E. schimperi*, shows that the two S.A. species *E. macrophylla* and *E. daphnoides* are not specifically distinct from it. *E. macrophylla* agrees in all essentials, but *E. daphnoides* differs somewhat in the shape and texture of the leaves; these are narrower and often become thicker and more coriaceous than those of typical *E. schimperi*. *E. macrophylla* is, therefore, placed in synonymy under *E. schimperi* and *E. daphnoides* is reduced to varietal rank in the same species:—

*E. schimperi* (A. DC.) Dandy, aggregate species.

#### (a) var. *schimperi*.

*E. schimperi* (A. DC.) Dandy in Andrews Flow. Pl. Anglo-Egypt. Sudan 2: 370 (1952). Type: Abyssinia, *Schimper* s.n. *E. Kellaua* Hochst. in Flora 26: 83 (1843). *E. macrophylla* E. Mey. ex A. DC. Prodr. 8: 218 (1844); Hiern. in F.C. 4, 1: 472 (1906). Type: Cape, between Kei and Bashee Riv., *Drege* s.n. *E. racemosa* Murr. var. *burchellii* Hiern. in F. C. 4, 1: 474 (1906).



*Kellaua schimperi* A. DC. in Ann. Sc. Nat. 2, 18: 20 (1842).

(b) var. **daphnoides** (Hiern.) de Winter stat. nov. *E. daphnoides* Hiern in Trans. Cambr. Phil. Soc. 12: 102 (1872); and in F.C. 4, 1: 42 (1906). Lectotype: Humansdorp, Burchell 4909. (I nominate the sheet at Kew, Burchell 7/4909/, „western bank of the Wagenbooms River on the north side of Lange Kloof”, a female specimen, as the type of *E. daphnoides* Hiern).



## Notes and New Records of African Flowering Plants.

By

Various Authors.

### ACANTHACEAE.

**Justicia minima** *A. Meeuse*, nom. nov.—*J. spergulaefolia* sensu C. B. Clarke in Dyer, Fl. Cap. 5, 1: 60 (1901), non T. Anders. Type: *Schlechter* 4267 (K, holo!, PRE, iso!).

A number of specimens of a *Justicia* had been collected in the Transvaal, which run in the key in Flora Capensis to "*J. spergulaefolia*" and indeed match *Schlechter* 4267 (PRE), the only gathering cited by Clarke. All these specimens, including the type gathering, came from a fairly restricted area in the Warmbaths, Waterberg and Potgietersrust districts of the Transvaal and it was felt that they might not be conspecific with the type of *J. spergulifolia* which was collected in Damaraland. Mr. W. Marais borrowed the holotype of the latter from T.C.D. (Dublin) and reported that it is undoubtedly a species of *Monechma*, probably *M. namaense* C. B. Clarke. The Transvaal specimens referred to above appeared to be without a valid name and the name "*minima*" was chosen because this reflects the very slender habit of this plant and the small flowers.

Characteristic of this species is the varying degree of pubescence. Specimens which are almost or completely glabrous are growing side by side with specimens which are rather densely pubescent with short stiff hairs. Very glabrous specimens also have glabrous inflorescences, but very hairy ones have a pubescent rhachis, pubescent bracts, bracteoles and calyx-segments.

The species can be best characterised as a miniature of the tropical African *J. linearispica* C. B. Clarke, which it resembles in habit, in the shape of the leaves and in the inflorescence, but all parts are considerably smaller. *J. minima* grows almost invariably in rock crevices on quartzite.

TRANSVAAL.—Locality not quite certain, but probably Potgietersrust district: Magalakwin River, *Schlechter* 4267 (K. holo!, PRE, iso!). Potgietersrust: between Bokpoort and Palala Heights, *Meeuse* 9349. Waterberg: Vyeboom near Nylstroom, *Meeuse* 9334, 9334a; near Naboomspruit, *Meeuse* 9736. Warmbaths: Hills North of Warmbaths on road to Nylstroom, *Smuts* and *Gillett* 3314, *Codd* 3448, *Repton* 793, *Sidey* 1329. (All cited specimens in PRE).

**Justicia montis-salinarum** *A. Meeuse* spec. nov. ex affinitate *J. orchioides* L.f., *J. odorae* Vahl, *J. philipsae* Rendle et *J. lortae* Rendle, sed inter alia habitu, indumento puberulo, foliis linearibus, corolla extus pubescenti, capsula minute denseque hirtiuscula differt.

Suffrutex perennis densus multicaulis ramosissimus habitu semigloboso 30–60 cm. altus. *Caules* plurimi lignosi subteretes glabrescentes cortice griseo sublevi vel ubrugoso obtecti, ramulis ulterioribus flavo-viridibus suffructosis subquadrangulatis

densissime minuteque puberulus vel farinosus, internodiis 1–2 cm. longis. *Folia* lineari-lanceolata subrigida integra sessilia subacuta subpungentia minute puberula in siccitate flavo-iridia 10–25 mm. longa et 1–2.5 mm. lata, nervo medio subtus prominulo. *Flores* solitarii in axillis foliorum superiorum sessiles. *Bracteolae* 2 lineari-lanceolatae attenuato-acutae minute hirtiusculae uninerves 5–6 mm. longae c. 0.75 mm. latae. *Calyx* profunde 5-fidus, firmiter herbaceus, dense minuteque hirtiusculus, tubo c. 1 mm. longo, lobis erectis subaequalibus lineari-lanceolatis attenuato-acuminatis uninervis c. 4 mm. longis 0.5–0.75 mm. latis. *Corolla* alba intus in faucibus purpureo-maculata, extus dense minuteque strigoso-pubescentis intus in faucibus sparse pilosula, 8–9 mm. longa, labio antico 3-lobato in faucibus transverse ruguloso cum lobo mediano suborbicularibus lobis lateralibus oblongo-rotundis, labio postico concavo leviter emarginato. *Stamina* in faucibus affixa, filamentis ad basin pilosulis, loculis antherarum inferioribus distincte caudatis, granulis pollinis ut in *Justicia*, poris 3 instructis. *Ovarium* ad apicem hirtiusculum, stylo infra medium sparse pilosulo. *Capsula* dilute ochracea, dense minuteque strigoso-hirsutula, stipitata, 8–9 mm. longa, parte stipitata complanata c. 3.5 mm. longa. *Semina* rufo-brunnea tumida papilloso-verruculosa, c. 2.5 mm. longa, 1.5 mm. lata, 1.25 mm. crassa.

TRANSVAAL.—Soutpansberg: Vivo, schoolgrounds, Mogg 24448 (PRE, J); slopes of Soutpansberg near Saltpan, Obermeyer, Schweikerdt & Verdoorn 168 (PRE); southern entrance of Sandrivierspoort, about 4 miles north of main road bridge, Meeuse 10213 (PRE, holo.).

Erect perennial suffrutex, greyish to subcanescent in appearance when fresh, forming semi-globose densely tufted bushes 30–60 cm. tall. *Stems* numerous, much-branched from the base up, the older parts woody, subterete, grey, with a smooth or faintly longitudinally wrinkled bark; ultimate ramifications wiry, subquadrangular, yellowish-green when dry, finely puberulous to farinose; internodes 1–2 cm. long. *Leaves* linear-lanceolate, stiff, entire, sessile, subacute to subpungent, thinly puberulous or farinose, drying yellowish-green, 10–25 mm. long and 1–1.5 mm. broad; midrib prominent on lower surface, remaining venation consisting of a sinuous marginal vein connected by a few (usually 3–6) short transverse lateral veins with the midrib, prominent on lower surface, indistinct on upper surface. *Flowers* solitary, sessile in upper leaf-axils, almost running into a sparse leafy terminal spike; bracteoles 2, linear-lanceolate, resembling the leaves in shape and texture, attenuate-acute, 1-nerved, 5–6 mm. long and about 0.75 mm. broad. *Calyx* deeply 5-fid, the same colour as the leaves, densely covered outside with very short stiff bulbous-based hairs and inside mainly in the upper part; tube about 1 mm. long; lobes erect, equal, linear-lanceolate, attenuate-acuminate, about 4 mm. long and 0.5–0.75 mm. broad at the base. *Corolla* white with purple markings in the throat, outside densely pubescent with stiff short hairs, inside with a few stiff hairs in the throat, 8–9 mm. long; anticus (lower) lobe 3-lobed with the middle lobe subrotundate and the lateral lobes oblong, rounded at the apex; the throat on this side transversely rugulose; posticus (upper) lip concave, with a rugula containing the style, slightly emarginate. *Stamens* with a few stiff hairs near the base of the filaments; lower anther-cells with a long nearly straight tail; pollen of the *Justicia*-type, ellipsoid, 3-colporate. *Ovary* glabrous except near the top; style shortly and thinly pilose in lower half. *Capsule* pale ochre, densely strigose-hirsutulous with short stiff usually retrorse hairs, stipitate, 8–9 mm. long of which 3.5 mm. taken up by the “stalk”. *Seeds* rather thick, elliptic-subquadrate in outline, of a somewhat reddish brown colour, finely and rather evenly papilloso-verrucose, about 2.5 mm. long, 1.5 mm. broad and 1.25 mm. thick.

This rather insignificant *Justicia* belongs to a group of species which have axillary flowers not forming a distinct terminal inflorescence but sometimes running into a leafy sparse spike which is not clearly separable from the remainder of the stem (section



*Calophanoides* of Fl. Cap. and Fl. Trop. Afr.). In this group it must be placed in the affinity of the shrubby perennial species such as *J. orchoides* L.f., *J. odora* Vahl, *J. phillipseae* Rendle and *J. lorteeae* Rendle, but it differs from the first two in the smaller flowers and the narrow leaves, from the other two among other things in the pubescence, hairy corolla and hairy capsule. The pollen is of the *Justicia*-type (Knötchenpollen of Lindau), with three germination pores.

The first gathering was apparently by Obermeyer c.s. twenty years ago, but the material was rather scanty and nobody ventured a description. Recent gatherings provided ample material and field-notes. The specimens O.S.V. 198 and Meeuse 10213 were compared at Kew and reported by Mr. W. Marais to be unmatched.

This plant is easily recognised in the field by its very dense low bushy habit which is not found in other species of the genus occurring in Southern Africa. It seems to prefer warm, dry and rocky situations and has so far only been found in a fairly small area comprising some drier localities in the foothills of the western part of the Soutpansberg range. It is not gregarious, the specimens gathered being apparently taken from single individual plants, and it is probably rare, but a careful search for this not very conspicuous species in suitable localities may prove that it is more wide-spread than the present records indicate.

**Petalidium** (Sect. *Petalidium* = Sect. *Haplanthus* Lindau) **luteo-album** A. Meeuse, spec. nov. ex affinitate *P. linifolii* T. Anders. et *P. lucentis* Oberm. sed inter alia foliis ellipticis vel oblongis (nec linearibus nec lineari-lanceolatis), floribus haud lilacinis, bracteis nec atri- nec purpurei-venosis differt.

Frutex glaber densus multiramis habitu semigloboso, 0.50–1 m. altus. *Caules* lignosi cortice griseo vel atri-purpureo obtecti, ramulis ulterioribus subdense foliosis viridibus vel albescens. *Folia* firmiter herbacea in siccitate pergamacea, flavo-viridia, elliptica vel oblonga, integra, obtusa vel subacuta interdum minute apiculata, 2–3.5 cm. longa, 0.5–1.5 cm. lata, cystolithis indistinctis raro infra conspicuis, petiolis brevibus ad c. 6 mm. longis. *Flores* axillares, solitarii, pedicellis gracilibus curvatis vel sinuatis 4–7 mm. (post anthesin ad 12 mm.) longis, bracteolis 2 planis late cordatis asymmetricis submembranaceis vel papyraceis dilute albo-viridibus interdum plus minusve purpurascens abrupte apiculatis subglabris integris distincte denseque reticulato-venosis 2.5–3 cm. (post anthesin ad 4.5 cm.) longae et latae. *Calyx* viridis, 5-fidus, tubo 2–3 mm. longo, lobis erectis inaequalibus linearibus acutis minute sparseque glanduloso-puberulis ciliatisque 6–10 mm. longis. *Corolla* dilute flava labio antico flavo, in faucibus fuscovariegata, extus praecipue infra medium et ad nervos sparse adpresse pubescens, intus ad basin loborum pilis albidis rigidis retrorsis paucis sparsim strigosa, tubo (parte cylindrata) c. 10 mm. longo 3 mm. lato, faucibus (parte infundibuliformi) c. 15 mm. longis ad apicem c. 15 mm. latis, lobis 4 posticis subrotundis c. 8 mm. longis et latis, lobo antico late orbiculari-rhomboides truncato emarginato c. 11 mm. longo 8 mm. lato. *Capsula* fusca glabra subnitida apiculata, 11–12 mm. longa, c. 6 mm. lata. *Semina* 1–2, 6 × 4 mm.

SOUTH WEST AFRICA.—Kaokoveld Reserve: Okonjombo, Watt O.P. No. 2732/G (PRE); near Orupembe (Anabib), Story 5730 (PRE, K); 20 m. W. of Otjiku on road to Orupembe, de Winter & Leistner 5683 (PRE, holo.! ; isotypes to be distributed to K, M, Windhoek, B, SRGH and elsewhere).

A much branched rounded shrublet 0.50–1 m. tall. Older stems woody, terete, somewhat swollen at the nodes, grey to rather dark purplish grey, nearly smooth but here and there with a few small and slightly raised circular white lenticels, ultimate branchlets mostly appearing as short lateral shoots, green or ash-grey to white, glabrous or puberulous when still very young, rather densely leafy and bearing the solitary flowers in the leaf-axils. *Leaves* firm, yellowish-green when dry, more pale greyish green when

fresh, elliptic or oblong, entire, obtuse with rounded or minutely apiculate apex, gradually narrowing at the base, very soon quite glabrous, 2-3.5 cm. long and 0.5-1.5 cm. broad; cystoliths in dried leaves indistinct or occasionally discernible on lower surface; midrib slender, prominent on lower surface, lateral veins usually only 2-3 on either side, finer nervation almost invisible except in the youngest leaves; petioles short, some attaining 6 mm. *Pedicels* slender, curved (usually upwards) or sinuous, 4-7 mm. in fruit up to 12 mm. long. *Bracteoles* very large, flat, greenish-cream sometimes more or less suffused with purple, orbicular-cordate, abruptly and sharply apiculate with asymmetrical cordate base and more or less triangular rather narrow basal sinus, entire, papyraceous and rather brittle when dry, nearly glabrous except for a rim of a sparse very short pubescence near the margin inside, with a distinct midrib and a fine reticulate nervation, 2.5-3 cm. long and broad under open flowers, in fruit enlarging to  $4.5 \times 4.5$  cm. *Calyx* green, 5-fid; the tube 2-3 mm. long; lobes linear, erect, acute, minutely and sparsely glandular-puberulous and ciliate, unequal in length, 6-10 mm. long, the tube in fruit elongating to 4 mm., the longest lobes to 12 mm. *Corolla* pale-cream with brown markings inside in lower side of throat and the lower (anticous) lip yellow; outside, mainly below the middle and on the veins, shortly and sparsely pubescent, inside with a few white stiff retrorse hairs at the bases of the lobes; the cylindrical part of the tube about 10 mm. long and 3 mm. in diam., the funnel-shaped portion (throat) about 15 mm. long and as much in diam. at the mouth; four posticous lobes suborbicular, about  $8 \times 8$  mm.; the anticous (lower) lobe broadly-orbicular-rhomboid, truncate and emarginate at the apex, about 11 mm. long and 14 mm. broad. *Capsule* brown, rather shiny, apiculate, 11-12 mm. long and 6 mm. broad. *Seeds* 1 or 2, much compressed, about  $6 \times 4$  mm.

This very distinct species was, as far as can be ascertained, collected for the first time by Dr. J. Watt, now Director of Agriculture, Windhoek, about twenty years ago when he was a Government Veterinary Officer. The two more recent gatherings provided ample material for the description.

It is a typical representative of the genus even in such minute details as the pubescent style. The solitary axillary ebracteate flowers with deeply 5-fid calyx indicate its place in the section *Petalidium* (= *Haplanthus* Lindau). Its nearest affinities appear to be with *P. linifolium* T. Anders. and *P. lucens* Oberm. which also possess large, flat and reticulate-veined bracteoles, but it differs in several respects such as broader leaves, a different colour of the corolla (which is mauve or bluish in the other species) and the concolorous (not blackish or purple, discolorous) venation of the bracteoles. The specimen Story 5730 was compared at Kew and the British Museum herbarium by our officer at Kew, Mr. W. Marais who reported that this plant is not represented in either herbarium and confirmed my conclusion that there is no other described species whose diagnosis could possibly apply to the Kaokoveld plant.

The specific epithet chosen refers to the colouring of the corolla, although it should be mentioned that cream or yellow colours are found in the corollas of several species of *Petalidium*; however as far as all available records show, the combination of cream and yellow in a single flower has not been observed in previously described species.

***Rhinacanthus xerophilus*** A. Meeuse, spec. nov., *R. rotundifolio* C. B. Clarke arcte affinis, sed caulibus subteretibus (haud acute sexangulatis), indumento caulium et foliorum densiore praecipue differt.

Suffrutex perennis e basi ramosus 20-70 cm. altus. *Caules* adscendentes vel suberecti, basi lignosi glabrescentes fuscentes, supra virides firmiter herbacei rigidi subteretes indistincte longitudinaliter sulcati, pilis brevibus curvatis dense pubescentes. *Folia* late elliptica vel ovata vel obovata vel triangulari-ovata interdum suborbicularia, sessilia vel petiolis 1-6 mm. longis instructa, lamina acuta vel obtusa interdum

emarginata vel minute apiculata basi rotundata vel subcordata raro decurrenti vel subcuneata integra vel subcrenata supra intense viridi in siccitate olivacea vel nigricanti minute subsparseque strigoso-pubescenti subtus pallidiore et praecipue ad nervos pilis plus minusve curvatis nunc subsparse nunc dense pubescenti ad subvelutina demum glabrescenti 1.4-5 (-6) cm. longa et 0.5-4 (-5) cm. lata. *Flores* sessiles vel subsessiles in paniculam terminalem 8-18 cm. longam 2-10 cm. latam more *Rhinacanthi* dispositi. *Pedunculi* teretes longitudinaliter subsulcati dense minuteque pubescentes vel pilosuli. *Bracteae bracteolaeque* minutae, pilosulae. *Calyx* profunde 5-fidus, pilis brevibus patentibus et pilis glandulosus pubescens, 5-6 mm. longus, tubo subnullo, segmentis anguste lineari-lanceolatis erectis acutis. *Corolla* alba intus in faucibus maculis dilute purpureis variegata, extus villosula et sparse glanduloso-pilosa, intus (labio postico excepto) subglabra, tubo tubuloso (17-) 22-25 mm. longo 1-1.5 mm. lato, lobis anticis obovato-ellipticis obtusis intus sparsissime praecipue ad basin glanduloso-pilosis 7-10 mm. longis 3.5-4.5 mm. latis, lobo postico lineari-oblongo acuto intus sparse glanduloso-pubescenti 6-8 mm. longo. *Genitalia* et *granula pollinis* ut in typo, stylo sparse pilosulo, ovario pilis brevibus subpatentibus et pilis glandulosus paucis dense pubescenti. *Capsula* apiculata, pilosula, 15-18 mm. longa, parte stipitata 7-9 mm. longa. *Semina* nigra, c. 3 mm. longa et lata.

TRANSVAAL.—Soutpansberg: Messina, Rogers 20759, 22599; Msekwa's Poort, Meeuse 9188; near Mara, Meeuse 10198. Sebasa: near Lake Fundusi, Bremekamp & Schweikardt 373. Pietersburg: Soekmekaar, Meeuse 9221 (PRE, holo.!, K, iso.!). Mokeetsi, Breyer h. No. 21450; 3 miles W. of Maliepsdrift, Meeuse 10644; Nelspruit: Kruger National Park, near Skukuza, Codd 5215, Van der Schijff 3407.

PORTUGUESE EAST AFRICA.—Sul do Save: Lourenço Marques distr., Ressano Garcia, Schlechter 11881.

SOUTHERN RHODESIA.—Ndanga: Mtilikwe Riv., Bangara Falls, Wild 4361 (SRGH, PRE).

(All cited numbers in PRE, Codd 5215, Meeuse 9188, 10198, Van der Schijff 3407 also in K).

Straggly to suberect subshrub, branched mainly near the base, 20-70 cm. tall. *Rootstock* woody. *Stems* ascending to suberect, woody at the base and there becoming covered with a thin pale brown bark; upper parts green, firmly herbaceous to wiry, rigid, subterete, indistinctly longitudinally sulcate and densely covered with a pubescence of short, patent to more or less curved hairs. *Leaves* firmly herbaceous, varying from broadly elliptic to (ob)ovate or broadly deltoid-ovate, sometimes suborbicular, subsessile or on 1-6 mm. long shortly pubescent petioles, acute or obtuse, often minutely apiculate, occasionally emarginate; rounded, truncate to subcordate, rarely decurrent or subcuneate at the base, entire or faintly crenate, dark green drying blackish, and with a rather sparse short strigose pubescence on upper surface, paler and usually much more densely shortly pubescent to velutinous on lower surface (more densely so on the veins), rarely noticeably glabrescent, 1-4.5 (-6) cm. long and 0.5-4 (-5) cm. broad. *Flowers* sessile or subsessile in small clusters or solitary borne on a typical paniculate branched *Rhinacanthus* inflorescence 8-18 cm. long and 2-10 cm. broad. *Peduncles* and *branches of the panicles* very similar to the stems in appearance but pubescence more and more interspersed with toadstool-shaped glandular hairs as the ramifications become finer. *Bracts* and *bracteoles* minute, thinly covered with short stiff hairs. *Corolla* white marked with mauve in the throat, pilose outside, nearly glabrous inside except on the upper lip; the tube (18-) 22-25 mm. long and 1-1.5 mm. in diam.; antical lip of 3 obovate-elliptic obtuse 7-9 mm. long lobes, which are very sparsely glandular-pubescent mainly near the base inside; postical lip linear-oblong, acute, sparsely glandular-pubescent inside, 6-8 mm. long. *Pollen-grains* as in the type species. *Ovary* densely



pubescent with short stiff hairs interspersed with a few glandular hairs; style very sparsely pilose. *Capsule* apiculate, stipitate, hairy, 15–18 mm. long of which 7–9 mm. taken up by the “stalk”. *Seeds* black, orbicular in outline with a notch near the hilum, about 3 mm. in diam.

This species is very close to *R. rotundifolius* C. B. Clarke and Mr. D. J. B. Killick who compared several Transvaal specimens such as *Meeuse* 9221 (an isotype), *van der Schijff* 3407 and *Codd* 5265 with a syntype of the latter (*Thomas* 7, K) reported the following differences, which were confirmed when a specimen of *R. rotundifolius* from Kismayu, Somalia (*Bally* 9508) was received on loan from the East African Herbarium, Nairobi.

*Thomas* 7.

1. Leaves strictly ovate (in *Bally* 9508 elliptic to oblong).
2. Leaves sparsely hairy with veins prominent on lower surface.
3. Stems sharply 6-angled in cross-section with 2–3 grooves between the angles, with very small white adpressed retrorse hairs, mainly on the angles.

*R. xerophilus*.

1. Leaves ovate-cordate and sometimes cordate.
2. Leaves densely pubescent on lower surface, veins not so prominent.
3. Stems subterete, more undulate in cross-section without angles or intermediate grooves, abundantly hairy all round with suberect hairs.

These differences may seem to be small, but they are apparently constant and in this genus the differences between the species are always small, so much so that the wide-spread African species *R. gracilis* Klotzsch has for a long time been treated as identical with (and a taxonomical synonym of) the Indian *R. nasutus* (L.) Kurz (= *R. communis* Nees).

To the differences mentioned by Mr. Killick may be added that the corolla-tube in *R. rotundifolius* was described as  $1\frac{1}{4}$  inch (about 30 mm.) long (in *Bally* 9508 it is 30–50 mm.) long, whereas in the plant described here the length of the corolla-tube, even in vigorous cultivated specimens, does not exceed 25 mm.; the width also differs: 1–1.5 mm. in *R. xerophilus*, 0.5–1 mm. in *Bally* 9508. Another difference between *R. xerophilus* and some related species may be found in the ecology. *R. xerophilus* seems to be restricted to open, gravelly or rocky open places in dry bushveld vegetations in areas with a low annual rainfall, classified by Acocks (Veld types of South Africa, 1953) as Arid Lowveld, Arid Sweet Bushveld and Mopani Veld, hence the specific epithet. *R. gracilis* is found in more humid situations, often in tropical lowland vegetation. The ecology of *R. rotundifolius* (recorded from Kenya, Tana River, and Somalia) is not known, but it is likely to grow in similar arid conditions as the species from Southern Africa and this may account for the great similarity in habit between these two geographically separated forms. It is possible that the two are derived from the same common ancestral form and developed independently into the present specifically different taxa, because they became geographically separated.

## AMARYLLIDACEAE.

*Cyrtanthus erubescens* Killick, sp. nova distinctissima, nullis e specibus notibus propinqua.

*Bulbi* ad 10 cm. alti 4–6 cm. diam. *Folia* 2–4-lorata 20–60 cm. longa 2–6 cm. lata basi rubro-marginata. *Scapi* 20–50 cm. alti 1–1.5 cm. diam. *Bractee* 2, 4–7 cm. longae 1.5–2 cm. latae. *Umbellae* 9–15-florae, pedicellis ad 5 cm. longis (fructiferis ad 7 cm.) erectis vel suberectis. *Perianthium* rubicundum 3–4 cm. 3–4 longum, tubo 8–10 mm. longo campanulato, lobis curvatis patentibus 2–3 cm. longis oblongo-lanceolatis, exterioribus 6.5 mm. latis, interioribus 6 mm. latis. *Stamina* 6, 3 in parte superiore faucium et 3 basi loborum interiorum inserta, antheris versatilibus. *Ovarium* 6 mm. longum 4–5 mm. diam. *Loculi* multiovulati. *Stigma* trifida, lobis recurvatis et marginibus leviter revolutis. *Capsulae* 2.5 cm. longae 1.7 cm. latae, seminibus compressis nitidis nigris.



NATAL.—Bergville District: locally frequent on grassy banks of stream, 9400 feet, Cathedral Peak Forest Station, *Killick* 1840; locally frequent in subalpine grassveld in moist gully below Windy Gap, c. 9300 feet, Cathedral Peak Forest Station, *Killick* and *Marais* 2187 (PRE, holotype); near upper contour path near minor stream below Inner Buttress, 6500 feet, Cathedral Peak Forest Station, *Nänni* s.n. (Nat. Herb. No. 28587).

*Bulbs* up to 10 cm. tall and 4–6 cm. diam., more or less gradually tapered from near base to neck, with membranous tunic. *Leaves* 2–4, developing at same time or slightly later than the inflorescence, strap-shaped, 20–60 cm. long, 2–6 cm. wide, central midrib prominent on under surface, margin red in lower third of blade. *Scape* 20–50 cm. tall, 1–1.5 cm. diam., hollow. *Bracts* 2, subtending umbel, 4–7 cm. long, 1.5–2 cm. wide, the outer appreciably larger than the inner. *Umbel* 9–15-flowered; pedicels varying in length, but rarely more than 5 cm. long (elongating to 7 cm. in fruit), erect or suberect. *Perianth* pink, 3–4 cm. long, with one of the inner perianth segments uppermost very slightly less spreading than all the others and with the style arching somewhat under it. *Tube* 8–10 mm. long, campanulate, lobes curved, spreading, 2–3 cm. long, oblong-lanceolate; outer lobes 6.5 mm. broad with small tuft of hairs within apex; inner lobes 6 mm. broad with few hairs at apex. *Stamens* 6, 3 attached to the throat of the perianth opposite the outer segments and 3 on the inner segments just below their base; anthers versatile. *Ovary* 6 mm. long, 4–5 mm. diam. *Loculi* many-ovuled, in 2 ranks. *Stigma* trifid, the lobes recurved with the margins slightly revolute. *Capsule* 2.5 cm. long, 1.7 cm. broad; seeds compressed, shiny, black.

This very attractive plant with umbels of blush-pink flowers has been found in only two places in the Drakensberg, both in the Cathedral Peak area. It was first collected in December 1952 by the author in a moist gully at 9300–9400 feet some distance below Windy Gap (Organ Pipes Pass). There it is fairly common in subalpine grassveld where it is often associated with boulders. The second station is a few miles further north below the Inner Buttress at 6500 feet. Climbers in the Drakensberg have occasionally come across the plant and have called it the “pink *Agapanthus*”. Its potential value as a cultivated plant has apparently been recognised, because climbers have at times made special expeditions to look for the plant.

When one uses Phillips's key to Amaryllidaceae in his Gen. S. Afr. Pl. (2nd Edition, 1951), this plant runs down to *Anoiganthus*. It agrees with Baker's original description of that genus in Journ. Bot. 76 (1878) except in two respects. Firstly, the stamens are not all inserted “at the throat of the tube”; three are situated on the inner perianth segments about 1 mm. above their base. Secondly, the flowers are pink instead of whitish or pale yellow. Neither of these characters ought to preclude this plant from *Anoiganthus*, consequently its inclusion in *Cyrtanthus* requires some explanation.

Baker in his Handb. Amaryll. ix (1888) and in Fl. Cap. 6, 171–172 (1896) distinguishes *Cyrtanthus* and *Anoiganthus* on the presence of versatile or basifixed anthers respectively. None of the specimens of *Anoiganthus* examined by the author had basifixed anthers; they were versatile. Baker himself in his original description of *Anoiganthus* describes the anthers as versatile. It is surprising, therefore, that he should use this character at all.

Phillips (l.c. p. 199) distinguished *Anoiganthus* from *Cyrtanthus* on the relative length of perianth tube to segments. In *Anoiganthus* the perianth tube is shorter than the segments and in *Cyrtanthus* the tube is much longer than the segments. The Drakensberg plant has segments which are 2–3 times longer than the tube, which would put it in *Anoiganthus*. In most species of *Cyrtanthus* the tube is longer than the segments, but in several species e.g. *C. affinis* R. A. Dyer, *C. clavatus* (L'Hérit.) R. A. Dyer, *C. bicolor*, R. A. Dyer and *C. brachyscyphus* Bak. the tube is often equal in length to the segments.

In *C. thorncroftii* C. H. Wright, the segments are as long as or longer than the tube. It seems reasonable then to enlarge our concept of *Cyrtanthus* to include plants with perianth tube shorter, equal or longer than the segments. The general facies of the Drakensberg plant is that of a *Cyrtanthus*.

*Anoiganthus* and *Cyrtanthus* have both been investigated cytologically. Gouws in Plant Life 5 (Herbertia Edition), 56-67 (1949) found that they have the same chromosome number, namely  $2n = 16$ . Wilsenach (ms.) investigated *Cyrtanthus* (among other genera of Amaryllidaceae) and arrived at the same number. In a summary of his work seen by the author Wilsenach suggests that our conception of *Cyrtanthus* should be modified to include *Anoiganthus*. However, the fate of *Anoiganthus* is best left to the considered judgement of some future monographer.

## COMPOSITAE.

***Helichrysum milfordiae* Killick**, sp. nov. affine *H. albo* N.E. Br., sed foliis capitulisque multo minoribus, involucri bracteis apice sanguineis differt.

*Herba* nana pulvinata 1-3 cm. alta omnino incana. *Folia* basalia dense rosulata obovata—spatulata 0.6-1.4 cm. longa 0.49-0.9 cm. lata apice subacuta ad rotunda, folia caulina lanceolata elliptica vel spatulata apice acuminata ad rotundata saepe arista membranacea subamplexicaulia. *Scapi* 3-12 cm. alti. *Capitula* 2.5-2.9 cm. diam. solitaria terminalia homogama. *Bractee involucri* 4-5 seriatæ lanceolatae ad ovatae acutae 0.6-1.2 cm. longae 1-4.5 mm. latae niveae saepe apice et basi sanguineae. *Receptaculum* leviter convexum et breviter alveolatum. *Styli* rami truncati. *Pappi setae* graciles apice plumosae. *Achaenia* glabra.

BASUTOLAND.—Drakensberg Area: on rocks, summit of Mount aux Sources, 9000 feet, *Thode* s.n. (Nat. Herb. No. 2749); summit of Mont aux Sources, 9500 feet, *Flanagan* 1972; rocky top of mountain in crevices between boulders, Thabana Ntlenyana, 11400 feet, *Guillarmod* 2332; in fissures of rocks on top of Thabana Ntlenyana, 11475 feet, *Coetsee* 597; fairly common on cliff faces, Castle Buttress Area, 9800 feet, *Killick* 2333.

NATAL.—Bergville District: locally abundant in cave above Organ Pipes Pass, Cathedral Peak Forest Station, 9600 feet, *Killick* 1990; forms extensive carpets in overhang at top of Organ Pipes Pass, Cathedral Peak Forest Station, 9700 feet, *Killick* 2322 (PRE, holotype); between rocks, in mats, rare, Cleft Peak, 9500 feet, *Esterhuysen* 23023.

A dwarf, cushion-forming herb, 1-3 cm. high, grey-lanate all over. *Basal leaves* densely rosulate, obovate to spatulate, 6-14 mm., 4-9 mm., apex subacuta to round; cauline leaves lanceolate, elliptic or spatulate, apex acuminate to round often with a prominent membranous arista, subamplexicaul. *Scapes* 3-12 cm. tall. *Heads* 2.5-2.9 cm. diam., solitary, terminal, homogamous. *Involucral bracts* 4-5-seriate, lanceolate to ovate, acute, 6-12 mm. long, 1-4.5 mm. wide (progressively longer and narrower towards centre except for innermost row which is shorter than penultimate row), white, shiny, often crimson (occasionally brown) at apex and base. *Receptacle* convex. shallowly honeycombed, corners of pits slightly produced. *Corolla* 3.5 mm. long, filiform, glabrous except on outside of lobes. *Style* branches truncate. *Pappus* of fine bristles, plumose at apex. *Achenes* glabrous.

This new *Helichrysum* is an attractive carpet or cushion-forming plant consisting of scores of tightly congested grey rosettes connected by horizontal rhizomes. The cushions are found on rocks on the summit of the Drakensberg above 9000 feet. In

the Organ Pipes Pass area *H. milfordiae* usually occurs on cliffs with a southern aspect or immediately below them. Occasionally it is associated with *Crassula* sp. (Killick 2321).

*H. milfordiae* is closely related to *H. album* N.E. Br., but differs in the very much smaller leaves and heads, and the crimson- (sometimes brown-) tipped involucre bracts. It should be noted that the gatherings of *H. milfordiae* from the Cathedral Peak area (Killick 1990, 2322 and 2333, and Esterhuysen 23023) are consistent in having an indumentum which is lanate-floccose i.e. the hairs intertwine in a random manner, whereas in the remaining specimens the hairs are more or less straight and adpressed. At first it was thought that this might be a specific difference, but the plants agree so closely in other respects that they have here been treated as one species.

The first gatherings of this species were made in the 1890's. They were Thode s.n. in February 1893, Flanagan 1972 in January 1894 and Thode 29 in January 1896—all from Mont aux Sources. It seems that fifty years elapsed before it was collected again as a herbarium specimen; the author found it growing at the top of the Organ Pipes Pass in May, 1953. Since then the plant has been collected several times as indicated by the other specimens cited.

This plant has been cultivated in gardens in Britain for many years under the name of *Helichrysum marginatum* DC. It differs from typical *H. marginatum* in its dwarf habit (rosette plus scape up to 12 cm. high as against 25 cm.), shorter leaves (up to 1.4 cm. instead of 5 cm. long), in being lanate all over, and in having crimson-tipped involucre bracts. Interest in the plant was probably stimulated by an article by Dr. R. Seligman in Bull. Alpine. Gard. Soc. 2, 168–178 (1933) entitled "Wild Flowers of South Africa". The part dealing with *H. milfordiae* reads: "The summit (Machache in Basutoland) and its approaches brought me three new treasures, a white *Dimorphotheca* nestling among the stones—a true scree plant if there ever was one—a tiny *Helichrysum* wedged firmly into the living stone, and in a sheltered spot a dwarf *Geranium*." Dr. Seligman included a photograph of the plant taken on the summit of Mount Machache (9300 feet).

How this species came to be grown in Britain can be gleaned from letters attached to a specimen of the plant in Kew Herbarium. The plant was sent to Kew for naming in June, 1947 by Dr. J. S. L. Gilmour, then Director of Wisley Royal Horticultural Society Gardens. Mr. A. A. Bullock dealt with the plant and decided that it was new to science, but that he would have to know more about its origin before describing it. Dr. Gilmour subsequently found out from Mr. W. E. T. Ingwersen that the plant was collected by the late Mrs. Helen A. Milford at Mont aux Sources in Basutoland and brought to England where it found its way to the gardens of alpine plant enthusiasts. The author has adopted Mr. Bullock's manuscript name of *H. milfordiae* honouring Mrs. Milford.

## CONVOLVULACEAE.

**Merremia guerichii** A. Meeuse, spec. nov.,—*M. guerichiana* (Engl. ex) Hallier f. in Engl. Bot. Jb. 18: 69 (1893), nomen tantum. Ab *M. quercifoliae* Hallier f. foliis profunder palmatilobis praecipue differt, ab *M. ampelophyllae* Hallier f. inter alia indumento setoso-piloso haud molliter pubescenti, ab *M. bipinnipartitae* (Engl.) Hallier f. indumento distinguenda.

Suffrutex. Radix lignosa perennis. Caules pauci vel plurimi, prostrati vel suberecti, 20–60 cm., interdum ad 90 cm., longi, 1.5–2.5 mm. diam., firmiter herbacei ad basin plus minusve lignosi, subtereti, sublevi vel longitudinaliter striati, pilis basi in crassatis subsparse vel subdense piloso-setosi demum glabrescentes et scabridi.



*Folia* firmiter herbacea in siccitate pergamea, lamina ambitu ovato-orbicularia profunde 3-5 palmatifida glabra vel ad nervos sparse setosa 1-5 cm. longa et lata, lobis lyratis vel pinnatifidis vel crasse acuteque dentatis, petiolis setosis 0.5-3 cm. longis. *Inflorescentiae* 1-2-florae, pedunculis satis gracilibus subteretibus sparse setosis 0.5-4 cm. longis, bracteolae minutae, pedicellis 0.5-2 cm. longis. *Calyx* viridis in parte inferiora subdense pilis basi incrassatis setosis, lobis erectis oblongis vel anguste ellipticis vel cuneato-oblongis acutis vel subobtusis frequenter minute apiculatis subaequalibus 12-18 mm. longis. *Corolla* infundibuliformis, alba vel flavescens, vinosoculata, glabra, 5-lobata, 2.5-3.5 cm. longa lataque, lobis obtusis interdum minute apiculatis. *Stamina* subaequalia ad basin dilata et pilis minutis rectis papilloso-puberula, pollen *Merremiae*. *Ovarium* subglobosum, glabrum. *Capsula* subglobosa, straminea, apiculata, glabra, c. 12 mm. diam. *Semina* atrogrisea vel fusca, puberula, c. 8 mm. longa.

SOUTH WEST AFRICA.—Kaokoveld: between Orupembe Waterhole and Kunene River, *de Winter & Leistner* 5741 (PRE, holo.! EA, K, M, SRGH, isos.!); Ananib (Orupembe), *Story* 5698; without precise locality: *Von Koehnen* s.n. (M). Omaruru: Brandberg, Tsisab Gorge: *R. & F. von Wettstein* s.n. (M), *Rhodes University Student* s.n. (PRE), *Merxmüller & Giess* 1654 (M, PRE).

Perennial suffrutex. *Stems* several from a woody rootstock, rather firm to wiry, young stems often erect, older ones often prostrate; young parts rather densely setose-pilose with patent bulbous-based stiff hairs; older parts glabrescent and becoming scabrid, usually more or less woody, ultimate length about 60 cm., occasionally up to 90 cm., width near the base 1.5-2.5 mm.; internodes on prostrate stems up to about 7 cm. long but usually shorter (2-5 cm.). *Leaves* firmly herbaceous drying pergameous; the lamina in outline ovate-orbicular, deeply 3-5-palmatifid, usually nearly glabrous with only a few setose hairs on midrib and main veins towards the base, 1-5 cm. long and broad; the lobes lyrate to pinnatifid or coarsely and acutely, usually more or less coarsely, dentate; the petiole setose, 0.5-3 cm. long. *Flowers* solitary or in 2-flowered cymes; peduncles rather slender but firm, nearly terete, sparsely setose, 0.5-4 cm. long; bracteoles minute; pedicels 0.5-2 cm. long. *Calyx* green, in basal portion rather densely setose or even bristly with stiff bulbous-based patent hairs; sepals subequal, erect, oblong, narrowly elliptic or cuneate-oblong, acute or subobtusate and usually minutely apiculate, 12-18 mm. long; in fruit turning brown, slightly enlarged (mostly in width) and glabrescent becoming somewhat scabrid in lower portion. *Corolla* funnel-shaped, white or pale yellow with wine-coloured or maroon "eye", glabrous, 2.5-3.5 cm. long and as much in diam., with a 5-lobed spreading limb, lobes of limb obtuse, occasionally minutely apiculate. *Stamens* subequal, at the laterally broadened base with papillose short stiff straight hairs. *Pollen grains* typical of the genus. *Ovary* subglobose, glabrous. *Capsule* subglobose, apiculate, straw-coloured, glabrous, about 12 mm. in diam. *Seeds* dark grey or brownish grey, puberulous, about 8 mm. long.

This plant has been collected on several occasions but seems to be restricted to a comparatively small area including a part of the Kaokoveld and the area of the Brandberg (Omaruru district) in South West Africa. It was most probably collected by Guerich for the first time about 70 years ago, but his specimen (in Berlin) was destroyed and it was never properly described, so that the evidence that "*Merremia guerichiana*" is the same plant as the one described here as "*guerichii*" is circumstantial: (1) *Guerich* 69 was collected at Soris-Soris, which is not far from the Brandberg, and (2) a second specimen was cited under *M. guerichiana* by Hallier, viz., *Fischer* 34 from East Africa. This caused some confusion when Dr. B. Verdcourt of Nairobi studied *Fischer* 34 a few years ago and decided it is *M. ampelophylla*. As he did not see the Guerich gathering he took it for granted that the two specimens cited by Hallier were indeed identical,



so that in a remark in Kew Bull. 1957: 348 Dr. Verdcourt stated that *M. ampelophylla* occurs both in East Africa and in South West Africa. The South West African plant is undoubtedly specifically different from *M. ampelophylla*, but is closely related to it, so that it is not surprising that one could confuse the species described here with the East African one. It follows that *Guerich* 69 must have been conspecific with *M. guerichii*, otherwise Hallier could not have cited it together with *Fischer* 34. Dr. Verdcourt has seen a specimen of *M. guerichii* and agrees that it is distinct from *M. ampelophylla*.

The identity of *M. guerichiana* seems, therefore, to be definitely established.<sup>(1)</sup> However, the specific epithet "*guerichii*" was chosen which conveys the same but is not nomenclaturally synonymous, so as to avoid the dangerous action of validating a name without access to the original type (*Guerich* 69). In this way a new gathering could be chosen as the type of *M. guerichii*, a solution which is much more satisfactory and not at variance with certain recommendations in the Code of Botanical Nomenclature.

### GRAMINEAE.

**Andropogon ravus** J. G. Anderson, sp. nov., *A. sylvatico* C. E. Hubbard affinis, sed ita differt: habitu brevior, cum rhizomatibus, culmi 2-3-nodosi glabri, vaginae quam internodia breviores, spiculae pedicellatae longiores, glumae spicularum pedicellatarum et glumae superiores spicularum sessilium sine aristis.

*Gramen* perenne ad 90 cm. altum (plerumque 45-60 cm.) rhizomatibus ramosis. *Culmi* erecti simplices 2-3-nodosi glabri obscure striati vel leves teretes, nodis glabris, internodiis exsertis glabris levibus. *Folia* ad 23 cm. longa 3-6 cm. lata plana linearia. *Vaginae* glabrae internodiis breviores, lamina summa saepe ad aristam brevem redacta, ligula membranacea ad 2 cm. longa. *Racemi* 7-12 cm. longi, spiculis pallidi-viridibus purpura suffusis. *Spiculae sessiles* lineari-oblongae 6-9 mm. longae callo obtuso barbato. *Glumae* subaequales, inferior canale profunde per medium fundum, tenuiter coriacea apicem versus admodum carinata carina anguste alata in dimidio superiore scabrida vel ciliata, superior naviformis triente superiore carina scabrida vel ciliata marginibus leviter ciliatis subacuta 1-3-nervata. *Lemma floris inferioris* 6-8 mm. longum 2-carinatum obtusum 3-nervatum marginibus acute inflexis hyalinis et in dimidio superiore ciliatis. *Palea* non nervosa hyalina 2-3 mm. longa *Lemma floris superioris* 5-6 mm. longum inter lobos acutos aristatum arista ad 2 cm. longa infra genu contorta *Palea* nulla. *Spicula pedicellata* dorsaliter compressa. *Glumae* inaequales, inferior 7-12 mm. longa plana carinata carinis et marginibus ciliis hyalinis rigidis apice mucronato vel obtuso, superior breviter naviformis 6-9 mm. longa 3-nervata vel obscure 5-nervata marginibus ciliatis apice acuto. *Flos inferior* sterilis lemmate 7-8 mm. longo marginibus inflexis in dimidio superiore obscure ciliato hyalino obtuso 3-nervato palea non nervosa hyalina. *Flos superior* masculinus, lemmate 6 mm. longo apice obtuso marginibus inflexis palea nulla. *Antherae* lineares 4-5 mm. longae.

CAPE PROVINCE.—Maclea District: near lower Pitsing, sandy banks of Lusio River, locally frequent, c. 4,700 feet, *Acocks* 12191.

NATAL.—Bergville District: Cathedral Peak, towards Indumeni, Cleft Peak, c. 7,000 feet, *J. M. Gomell*; occasional in *Themeda triandra* Grassveld c. 6,700 feet, *Killick* 1261 (PRE, holotype).

<sup>(1)</sup> Note added in proof: Dr. S. J. van Oostroom of the Rijksherbarium, Leiden, kindly sent me the notes on *M. guerichiana* which he found among the unpublished manuscripts left by Hallier. These notes include a detailed description which agrees perfectly with the plants cited above (bulbous-based hairs on vegetative parts and calyx, and similar details) and Hallier mentions only *Guerich* 69 (herb. Berol.). This is the decisive evidence for the identity of "*M. guerichiana*" with the plants described here as *M. guerichii*.

ORANGE FREE STATE.—Bethlehem District: Golden Gate, c. 6,000–7,500 feet, *Story* 1957.

SWAZILAND.—Mbabane: Ukutula, c. 4,300 feet, *Compton* 25593.

Perennial, up to 90 cm. tall, usually 45–60 cm., with a branched knotty system of rhizomes. *Culms* erect, simple, 2–3-noded, glabrous, faintly striate or smooth, terete; nodes glabrous; internodes exerted, glabrous and smooth. *Leaves* up to 23 cm. long, 3–6 mm. wide, flat, linear, tapering to a setaceous point, narrowed towards the base or base slightly rounded, glabrous, glaucous, margins often scabrid; sheaths glabrous, striate, pallid or upper often suffused with purple, shorter than the internodes, leaf blade of uppermost sheath often reduced to a short awn, mouth often with a few long hairs; ligule membranous, scarious, up to 2 mm. long. *Inflorescence* of 2 (very occasionally 3) spike-like racemes, shortly pedicelled or lowermost sessile. *Racemes* 7–12 cm. long; spikelets light green suffused with dull purple, paired, lower sessile, upper pedicelled. *Sessile spikelets* linear-oblong, 6–9 mm. long; callus obtuse, bearded. *Glumes* sub-equal, lower with a deep median groove, thinly coriaceous, strongly keeled upwards, mucronate, keel narrowly winged, scabrid to ciliate in the upper half; upper boat-shaped, with a scabrid or ciliate keel in the upper third, finely ciliate on the margins, subacute, 1–3-nerved. *Lemma* of the lower floret 6–8 mm. long, 2-keeled with sharply inflexed margins; margins ciliate in the upper half, hyaline, obtuse, 3-nerved. *Palea* a nerveless hyaline scale 2–3 mm. long. *Lemma* of upper floret 5–6 mm. long, awned from between the acute lobes; awn up to 2 cm. long, twisted below the knee. *Palea* absent. *Pedicelled spikelet* dorsally compressed. *Glumes* unequal; lower 7–12 mm. long, keeled, keels and margins with stiff hyaline cilia, apex mucronate or obtuse; upper shallowly boat-shaped, 6–9 mm. long, 3- or faintly 5-nerved, margins ciliate, apex acute. *Lower floret* sterile. *Lemma* 7–8 mm. long, margins inflexed, sparsely ciliate in upper half, hyaline, obtuse, 3-nerved. *Palea* a nerveless hyaline scale. *Upper floret* male. *Lemma* 6 mm. long, apex obtuse, margins inflexed. *Palea* absent. *Anthers* linear, 4–5 mm. long.

*Andropogon ravus* is occasional in *Themeda triandra* grassveld on mountain slopes near Mbabane in Swaziland and in the foothills of the Drakensberg from Bethlehem in the Orange Free State to Maclear in the Cape Province. In the Bergville and Estcourt districts it occurs on the terrace immediately below the main Drakensberg escarpment between 6,000 and 7,000 feet. According to Mr. D. J. B. Killick, who has analysed the sourveld in the Cathedral Peak area, *A. ravus* provides 0·75 per cent to 0·95 per cent of the basal cover in a total grass cover of between 40 per cent and 47 per cent. He also states that it is readily recognised in the field, even when not in flower, because of its glaucous-grey colour.

This grass is closely allied to *A. sylvaticus* C. E. Hubbard described from Nyasaland. Our material was compared with this at Kew. The main differences are as follows:

*A. sylvaticus* is a tufted perennial 1–1·3 m. high with the leaf-sheaths longer than the internodes and the upper sheaths pilose with lax soft hairs, whereas *A. ravus* has a system of branched knotty rhizomes, is generally shorter and rarely up to 90 cm. tall and the glabrous leaf-sheaths are shorter than the internodes.

In *A. ravus* the pedicelled spikelets are longer and up to 12 mm. long compared with those of *A. sylvaticus* which are 7–8 mm. long. The apex of both the upper and lower glumes of the pedicelled spikelet of *A. sylvaticus* is aristate whereas the upper glume in *A. ravus* is acute and the lower mucronate or obtuse. The apex of the upper glume of the sessile spikelet in *A. sylvaticus* is aristate at the apex and subacute in *A. ravus*.

The awn of the lemma of the upper floret of the sessile spikelet is up to 2·0 cm. long in *A. ravus* and only up to 1·5 cm. long in *A. sylvaticus*.

**Danthonia stereophylla** J. G. Anderson, sp. nov., *D. drakensbergensi* affinis, sed ita differt: folia rigidissima inflorescentiae aequalia vel inflorescentiam superantia, appendices laterales lemmatis angustiores, aristae loborum lemmatis longiores.

*Gramen* perenne caespitosum ad 80 cm. altum. *Culmi* erecti simplices compressi obscure nodosi glabri leves. *Folia* rigidissima subpungentia glabra levia inflorescentiae aequalia vel inflorescentiam superantia, vagina rigida pallida striata intus pubescente, inferiore indurata, ligula ad seriem densam ciliarum brevium redacta, laminis filiformibus rigidis ad 36 cm. longis conduplicatis supra striatis minute scaberulis, supra ligulam sericeo-pubescentibus marginibus integris. *Paniculae* erectae laxae contractae angustae lanceolatae ad 18 cm. longae, rhachide subangulata striata glabra levi, ramulis subteretibus leviter patentibus solitaribus in axillaribus sericeis, pedicellis 3–20 mm. longis angulatis vel subteretibus glabris nonnunquam scaberulis. *Spiculae* ad 2 cm. longae pallidi-flavae nitidae. *Glumae* lanceolatae, 1.1–1.8 cm. longae subaequales pallidae nitidae glabrae leves, superiores marginibus basin versus saepe pubescentes, 1-nervosae carinatae acutae. *Rhachillae internodii* glabri apicem versus ampliati complanati. *Lemmata* lanceolata ad 16 mm. longa bilobata, supra glabra, intus sparse pilosa, marginibus media sub parte pilosa, apicem versus sparse pilosa pilis non caespitosis, lobis ad 9 mm. longis margines versus tenuiter scabris acuminatis in aristam gracilem scabram productis. *Callus* truncatus dense barbatus. *Arista media* geniculata ad 2 cm. longa scaberula, apicem versus angustior basin versus complanata et spiralliter contorta non lobis adnata. *Paleae* ad 7 cm. longae intus pubescentes apice bilobatae distincte carinatae carinis et lobis breviter ciliatis lobis ad 2 cm. longis. *Antherae* circiter 3 mm. longae. *Ovarium* glabrum stylis distinctis.

**BASUTOLAND.**—Drakensberg Area: often dominant on rock outcrops on summit of Drakensberg between Indumeni Dome and Cleft Peak, 9,800 feet, *Killick* 2349; common on rock outcrops on summit of Drakensberg in Cleft Peak Area, c. 9,800 feet, *Killick & Marais* 2183.

**NATAL.**—Estcourt District: edge of south krantzes, frequent, Tabamhlope, c. 6,400, *Acocks* 11472; summit and elsewhere common, Bushman's Pass, 7,100–9,000 feet, *West* 1690; occasional on slopes of Drakensberg near Champagne Castle, 10,000 feet, *West* 799. Bergville District: Tutumi Valley, 9,000 feet, *Killick* 2339; Cathedral Peak Forestry Station, 6,300 feet, *Killick* 1317; 7,400 feet, *Killick* 1184 (PRE, holotype).

A rigid, wiry, tufted, perennial. *Culms* erect, simple, up to 80 cm. high, compressed, obscurely noded, glabrous and smooth. *Leaves* very rigid, subpungent, glabrous, smooth, reaching up to or overtopping the inflorescence; sheaths rigid, pale, striate above and minutely scaberulous, sericeous above the ligule, margins entire. *Panicle* erect, loosely contracted, narrowly lanceolate, up to 18 cm. long; rhachis sub-angular, striate, glabrous and smooth; branches sub-terete, slightly spreading, solitary or apparently binate, lower up to 7 cm. long, upper shorter, sericeous in the axis; pedicels 3–20 mm. long, angular or subterete, glabrous, occasionally scaberulous. *Spikelets* up to 2.0 cm. long, pale yellow-green, shiny. *Glumes* lanceolate, 1.1–1.8 cm. long, sub-equal, pale, shiny, glabrous and smooth, upper glume often with a few long hairs on the margin towards the base, 1-nerved, carinate, acute. *Rhachilla internodes* glabrous, broadened towards the apex and flattened. *Lemmas* lanceolate, bilobed, up to 16 mm. long (including the lobes) glabrous dorsally, sparsely hairy on the inside, pilose near the margin from about the middle downwards, sparsely pubescent on the margin upwards, hairs usually not arranged in distinct tufts; lobes up to 9 mm. long, finely scaberulous towards the margin, acuminate and gradually tapering into a scaberulous, slender awn. *Callus* truncate, densely barbate. *Central awn* geniculate, up to 2 cm. long, scaberulous, tapering towards the apex, flattened towards the base and spirally contorted, not adnate to the lobes. *Palea* up to 7 mm. long, pubescent on the inside, apex 2-lobed, distinctly keeled; keels and lobes shortly ciliate, lobes up to 2 mm. long. *Anthers* about 3 mm. long. *Ovary* glabrous; styles distinct.



*Danthonia stereophylla* is closely related to *D. drakensbergensis* Schweick. The distribution of these two species in the Drakensberg overlaps, but they can be distinguished on both ecological and morphological grounds.

*D. stereophylla* occurs on the Little Berg and its outliers (e.g. Tabamhlope), and on the main Drakensberg escarpment from 6,000 feet to the summit at c. 11,000 feet. So far it has only been collected between Bushman's Pass (Langalibalele's Pass) and Cleft Peak, but it has been recorded further north at Mont Aux Sources by Mr. D. J. B. Killick. At its lower altitudinal limits it grows on outcrops at the edge of koppies, and in the alpine zone it is often dominant on dry basalt cliffs and horizontal pavements. Its habitat is essentially xeric. *D. drakensbergensis* is restricted to the sub-alpine and alpine zones above 8,000 feet and, in contrast to *D. stereophylla* it occupies mesic situations on streambanks and seepage areas.

Vegetatively, the plants can be distinguished quite easily in the field. *D. stereophylla* is a wiry plant up to 80 cm. tall with rigid, erect or suberect, grey-green leaves, whereas *D. drakensbergensis* is a taller plant (up to 100 cm. high) with softer, olive-green leaves. A peculiar feature of *D. drakensbergensis* (also of *D. macowanii* Stapf) which is not evident in *D. stereophylla* concerns the behaviour of old leaves; the leaves break off a little distance above the ligule and the portion remaining splits along the middle nerve and the resultant halves recurve outwards at the apex.

The main differences in the spikelet are:

The hairs of the lemmas of *D. drakensbergensis* are arranged in 3 distinct tufts on each side, arranged in an oblique row at about the middle while the margin of the lemma is glabrous downwards. In *D. stereophylla* the hairs are arranged in a more or less continuous band along the margin, with long soft hairs from the base to the middle, and short rather sparse hairs from the middle to the apex. There is usually no definite formation of tufts, but the hairs at the middle occasionally aggregate to form a single tuft.

In *D. drakensbergensis* the lobes of the lemmas are broad, and taper rather abruptly into the awns. In *D. stereophylla*, however, the lobes are narrow and taper very gradually into the long slender awns, so that it is impossible to say where the lobes end and the awns begin.

The lemmas (lobes plus awn) of *D. stereophylla* are 10–16 mm. long and up to 10 mm. in *D. drakensbergensis*. Schweickerdt in his description of *D. drakensbergensis* in Fedde Rep. XLIII, 88 (1938) gives the length of the lemmas as up to 14 mm., but it is possible that his range of material included specimens of *D. stereophylla*.

*Panicum volutans* J. G. Anderson, sp. nov., affine *P. obscuranti* (Woodrow) Stapf, sed nodis hirsutis, spiculis glumis et lemmatibus floris inferioris longioribus multo acuminatioribus, gluma inferiore manifesto 3-nervata differt.

*Gramen* annum. Culmi erecti basi geniculati nodis hirsutis. Folia hispida pilis e tuberculis minutis ortis praesertim superne; vaginae externe pilis e tuberculis minutis ortis. Paniculae 40 cm. longae 25 cm. latae effuse ramosae. Spiculae 6.0–6.5 mm. (raro 5.5 vel 7.0 mm.) longae. Gluma inferior 4.5–5.0 mm. longa, longo-acuminata manifesto 3-nervata, nervo uno secundaris divergente ab nervorum exteriorum, nervis primariis scaberulis; superior 6 mm. longa longo-acuminata manifesto 7–9 nervata nervis scaberulis. Lemma floris inferioris 4.0–4.5 mm. longum longo-acuminatum 7-nervatum. Antherae 1.5 mm. longae.

CAPE PROVINCE.—Vryburg District: Armoedsvlakte, c. 3,960 feet, Mogg 8108.

NATAL.—Estcourt District: Moordspruit, 8 miles north of Estcourt, c. 3,500 feet, Codd 2466; Moordspruit near Estcourt c. 3,500 feet. Acocks 9947.



TRANSVAAL.—Rustenburg District: 35 m. north of Swartruggens, c. 3,900 feet, *Acoccks* 19179. Pretoria District: Onderstepoort, *Theiler* 27137; *Leendertz* 11335; Wonderboom Poort, *Mogg* 9937; Boschkop, 20 m. east of Pretoria, along banks of small river, *Kinges* 1721; Koedoespoort, *Pole-Evans* 327; Middelkop Farm near Pienaars River, *Smith* 2169; Rissik, c. 4,500 feet, *Robinson* sn.; Onderstepoort, c. 4,300 feet, *du Toit* 14; *Franks* 10616. Ermelo District: Between Bethal and Ermelo, *Codd* and *Muller* 268. Naboomspruit District: Vogelstruispan, *Galpin* M. 548. Standerton District: Teakworth, *Sient* sn.; New Denmark, *Marais* 16. Waterberg District: Bingley, *Kopje Alleen*, *Lyall Soutter* sn. Warmbaths District: Crecy, *Barenbrug* 1. Ventersdorp District: abundant in cultivated lands in vleis, *Louw* 1713 (PRE, holotype).

A loosely tufted annual. Culms up to 75 cm. tall, often sparingly branched, erect from a geniculate base, often rooting at the lower nodes; internodes terete, glabrous, smooth or faintly striate, easily compressible, lower often tinged with purple; nodes hispid. Leaves up to 23 cm. long and 1 mm. broad, linear, tapering to a sub-setaceous apex, hispid with bulbous-based hairs on both surfaces, the upper more hairy than the lower, margins scabrid; ligule a membranous long-ciliate rim; sheath striate, outer surface hispid with bulbous-based hairs, inner surface glabrous, usually tinged with purple. Panicle large, up to 40 cm. long and 25 cm. broad, profusely branched, branches with 1–3 spikelets at their apex, naked below, lowest primary branches whorled, base often enclosed in the uppermost sheath; rhachis angular, grooved, scaberulous on the angles, often tinged with purple. Spikelets 6.0–6.4 mm. (rarely 5.5–7.0 mm.) long, borne singly at the tips of long pedicels, lanceolate, acuminate, green, usually tinged with purple. Glumes unequal; lower 4.5–5.0 mm. long, long acuminate, membranous, prominently 3-nerved with 1 secondary nerve diverging from each of the outer primary nerves, primary nerves scaberulous; upper 6.0 mm. long, long acuminate, membranous, prominently 7–9 nerved with the nerves scaberulous. Lower floret barren. Lemma 4.0–4.5 mm. long, long acuminate, membranous, 7-nerved. Palea 2.0 mm. long, elliptic-oblong, hyaline. Upper floret bisexual. Lemma 2.75 mm. long, crustaceous, hard, smooth, narrowly oblong, apex obtuse, faintly 5-nerved, yellowish-grey with the nerves showing up as light-coloured lines. Palea 2.75 mm. long, narrowly oblong, apex obtuse. Anthers 1.5 mm. long.

*Panicum volutans* is found mainly in black turf soil in cultivated and other disturbed areas. It is one of the grasses known as “Rolling grass” or “Tumble Weed”, an allusion to the panicle which breaks off as a unit when mature and is carried away by the wind.

It is closely related to the Indian grass *P. obscurans* to which it was formerly erroneously referred. However, Mr. B. de Winter, found at Kew in 1952, that the South African plant is specifically distinct. Another close relative is *P. hippothrix* K. Schum. a tropical African species which is doubtfully distinct from *P. obscurans* (Woodrow) Stapf. Stapf in *Flora of Tropical Africa* 9, 699 (1902) says that *P. hippothrix* is “very similar and possibly identical with *P. obscurans* from the Deccan, but the blades of *P. obscurans* are much wider (up to 7 lin) and the panicle is perhaps on the whole more open with slightly larger spikelets”. Mr. de Winter supports the view that these species are probably synonymous since he could find no significant difference when dissecting spikelets of both at Kew.

Chippindall in the “Grasses and Pastures of South Africa” 328 (1955) refers to it as *Panicum* sp. aff. *P. hippothrix* K. Schum. because a valid name was not available at the time.

*P. volutans* differs from *P. obscurans* as follows: In *P. obscurans* the spikelets are about 4 mm. long with the lower glume approximately 3 mm. and the upper approximately 4 mm. long. In *P. volutans* the spikelets are about 6 mm. (rarely 5.5–7.0 mm.)

long with the lower glume 4.5–5.0 mm. and the upper glume 6.0 mm. long. The glumes and the lemma of the lower floret are much more acuminate than in *P. obscurans*. The nervation of the lower glume and the fertile floret is also different. In *P. obscurans* the lower glume is prominently 5-nerved, whereas in *P. volutans* it is prominently 3-nerved with a faint secondary nerve diverging on each side of the outer primary nerve. The fertile floret tends to turn brown in colour with the nerves showing up as light coloured lines. This is not the case in *P. obscurans*. Vegetatively there is very little difference between the two species except that the nodes are glabrous in *P. obscurans* and loosely to densely hirsute in *P. volutans*. The panicle is perhaps more rigidly branched than that of *P. obscurans*.

### TILIACEAE.

**Corchorus confusus** Wild, sp. nov.; affinis *C. triloculari* L. sed habitu perenni, a *C. asplenifolio* Burch. sed pedunculo fructuoso recto foliis anguste lanceolatis vel ovatis, ramulis omnibus partibus patenti-pilosis, a *C. angolensi* sed petiolis distincte brevioribus et indumento differt.

*C. serraeifolius* var. *lancifolius* Szyszyl., Polyp. Thalam. Rehm.: 61 (1887) pro parte quoad specim. Rehm: 4200 (BM; K) nomen nudum. *C. trilocularis* sensu Burt Davy, Man. Fl. Pl. Ferns Transv. & Swazil. 1: 257 (1926) pro parte excl. specim. Thornecroft 2058 et Nelson 381. Non *C. trilocularis* L.

*Herba* perennis, radice lignosa, ramulis annuis ad 0.6 m. longis subprostratis vel erectis omnibus partibus saltem juvenilibus patenti-pilosis. *Folia* petiolata, petiolo ad 8 mm. longo omnibus partibus patenti-pilosis; lamina ad  $7 \times 2.6$  cm., anguste lanceolata vel ovata, utrinque praesertim nervis pilosa, apice acuta vel obtusa, basi rotundata vel leviter cordata ecaudata vel aliquando caudata c. 2 mm. longa, margine crenata vel crenato-serrata, nervis basalibus 3–5 valde arcuato-adscententibus, nervis lateralibus utrinsecus 6–12, nervis omnibus supra leviter prominulis, subtus prominentibus; stipulae ad 6 mm. longae, setaceae, sparse pilosae. *Inflorescentia* axillaris; cymae pro nodo unicae, oppositifoliae, (1) 2–3-florae; pedunculi 0.4–2.5 cm. longi, omnibus partibus pilosis; pedicelli pedunculis similes, ad 0.8 cm. longi; bractae ad 6 mm. longae, setaceae, sparse pilosae. *Alabastra* ovoidea demum oblongo-ovoidea, plerumque apiculata. *Sepala* ad  $1 \times 0.15$  cm., lineari-lanceolata vel anguste lanceolata, apice caudato-acuminata, extus pilosa. *Petala* flava, quam sepalis paullo breviores, oblanceolata vel obovata, basi breviter unguiculata ciliata. *Androgynophorum* c. 0.5 mm. altum ad apicem annulo glabro leviter undulato instructum. *Stamina* c. 50, filamentosa. *Ovarium* 3-loculare, trigono-cylindricum, dense pubescens; stylus c. 2.5 mm. longus, tenuis, glaber. *Capsula* c.  $3 \times 0.2$  cm., subcylindrica, pedunculo fructuoso recto, apice obtusa, sparsissime scabroso-pilosa demum glabrescens; seminibus numerosis c.  $2 \times 1.2$  mm. intense brunneo-griseis.

CAPE PROVINCE.—Griqualand East, Umzimkulu R., fl. & fr. xii. 1884, Tyson 1413 (K; PRE).

NATAL.—Zululand, Egoa Farm, fl. & fr. i. 1922, Curson s.n. (PRE); Hlabisa, fl. 10.iv.1954, Ward 2306 (PRE). Fort Yolland, fl. & fr. 19.iii. 1903, Medley Wood 8976 (PRE). Estcourt, fl. & fr. 15.xii.1937, West 527 (PRE).

TRANSVAAL.—Barberton, fl. & fr. ix–xii.1889, Galpin 577 (K; PRE). Johannesburg, fl. xi.1902, Rand 1061 (BM). Shiluvane, fl. iii–v.1905, Junod in Herb. Transv. Mus. 4895 (PRE). Lydenburg, Waterval Boven, fl. & fr. 20.xii.1914, Rogers 10933 (PRE). Pretoria, Aapies Poort, fl. & fr. 1875–1880, Rehm: 4200 (BM; K); Pretoria, fl. 6.xii.1919, Verdoorn 69 (PRE). Rietvlei Reserve, fl. & fr. xi.1946, Repton 3170 (PRE). Kruger National Park, 5 m. N. of Pretorius Kop, fl. & fr. 4.ii.1949, Codd & de Winter 4960 (K, holo.; PRE).

SWAZILAND.—Without precise locality, fl. vi.1910, *Stewart* in *Herb. Transv. Mus.* 8999 (PRE).

MOZAMBIQUE.—Lourenço Marques, Incanhini, fl. & fr. 13.i.1898, *Schlechter* 12024 (K). Umbeluzi, fl. & fr. 27.x.1952, *Myre & Carvalho* 1283 (LM; K).

SOUTHERN RHODESIA.—Gwelo District: 15.iv.1905, *Gardner* 40 (K). Gwanda District, fl. 17.xii.1956, *Davies* 2386 (K; SRGH).

This species has been frequently confused in the past with *C. asplenifolius*; superficially there is a resemblance but the straight fruiting peduncles and stems hairy on all sides render it easy of recognition as a rule. In addition there is on the whole a difference in leaf-shape and the fruits are always quite straight; in *C. asplenifolius* they are typically slightly falcate. Burt Davy (loc. cit.) included this taxon under *C. trilocularis* but our plant is an indigenous perennial and cannot be conspecific with the annual weed *C. trilocularis*, which is distributed throughout the tropics and subtropics of the Old World. Our plant is also very near *C. angolensis* but the latter species has markedly longer, more slender petioles and acuminate, ovate-lanceolate leaves: it is also more nearly glabrous and although quite closely related it has a noticeably different facies.

***Corchorus merxmülleri*** Wild, sp. nov.; *C. angolensi* Exell & Mendonça affinis sed foliis ovatis utrinque dense stellato-tomentellis.

*Suffrutex* c. 2 m. altus ramis numerosis late patulis griseo-tomentellis demum glabrescentibus, cortice brunneo. *Folia* petiolata, petiolo ad 6 mm. longo, utrinque griseo-tomentello; lamina ad  $2.2 \times 1.6$  cm., ovata, apice acuta, basi leviter cordata, margine valde serrato-dentata, utrinque griseo-tomentella, nervis lateralibus utrinsecus 4, supra inconspicuis, subtus prominentibus; stipulae ad 2 mm. longae, subulatae, griseo-tomentellae. *Inflorescentia* axillaris, cymae pro nodo unicae, oppositifoliae, 1–2-florae; pedunculi ad 2 mm. longi, griseo-tomentelli; pedicelli ad 5 mm. longi, griseo-tomentelli; bractaeae 1.5 mm. longae, subulatae, griseo-tomentellae. *Sepala*  $5.6 \times 0.75$ –1.0 mm., anguste oblanceolata, apice longe acuminata, dorso leviter carinata, extus griseo-tomentella, intus glabra. *Petala* flava,  $9 \times 4.5$  mm., anguste obovata, basi breviter unguiculata margine minute ciliata. *Androgynophorum* c. 0.5 mm. altum. *Stamina* c. 60, filamentosa. *Ovarium* 3-loculare, trigono-cylindricum, brevissime tomentellum; stylus 4 mm. longus, glaber. *Capsula*  $3.4\text{--}4.5 \times 0.15$  cm., subcylindrica, leviter torulosa, obtuse 2 mm. rostrata, griseo-tomentella demum sparse stellato-puberula, pedunculis maturitate rectibus; seminibus numerosis brunneis c.  $2 \times 1$  mm. subcylindricis.

SOUTH WEST AFRICA.—Karibib, Erongogebirge, fr. 17.ii.1953, *H. Kinges* 3257 (M): bush. Omaruru, Otjihorongo Reserve, N. sides of porphyritic koppies on the Ugab E. of Rooipoort, fl. & fr. 15.ii.1958, *H. Merxmüller & W. Giess* 1620 (M, type): bush 2 m. tall, 3 m. wide.

This species is similar in habit to and is related to *C. angolensis* Exell & Mendonça but its small ovate tomentellous leaves give it a very distinctive appearance. It is an unusually large plant for a *Corchorus* species.

***Corchorus pinnatipartitus*** Wild, sp. nov.; *C. asplenifolio* Burch. affinis sed foliis profunde pinnatipartitis.

*Herba* perennis, radice lignosa, ramulis annuis usque ad 20 cm. longis suberectis vel prostratis glabris sed lineis pilis crispis munitis. *Folia* petiolata, petiolo ad 7 mm. longo, parte adaxiali pilosa, parte abaxiali glabra; lamina ad  $2.5 \times 1.2$  cm., ambitu anguste oblanceolata sed profunde pinnatipartita usque ad  $\frac{3}{4}$  lobata, aliquando ad basin



leviter palmatipartita, lobis versus folii basin majoribus obtusis vel subacutis simplicibus raro laterale l-dentatis, apice obtusa vel subacuta, basi truncata vel leviter cordata ecaudata, utrinque minute punctulata, utrinque glabra vel costa subtus minute sparse puberula; stipulae 2 mm. longae, lanceolatae, apicibus subulatis. *Inflorescentia* axillaris; cymae pro nodo unicae, oppositifoliae, 1-3-florae; pedunculi c. 1 mm. longi vel nulli; pedicelli ad 1 cm. longi, tenues, puberuli; bracteae c. 1 mm. longae, setaceae. *Sepala* plerumque purpurina, c. 7 mm. longa, oblanceolata, apice subacuta vel acuta, glabra. *Petala* flava vel plerumque roseo-purpurea suffusa, c. 7 mm. longa, anguste obovata, basi breviter unguiculata minute ciliata. *Androgynophorum* c. 0.25 mm. altum. *Stamina* numerosa, filamentosa. *Ovarium* 3-loculare, ellipsoideum, aliquantum trigonum, minutissime glanduloso-papillosum; stylus 3 mm. longus, glaber. *Capsula* c.  $2 \times 0.2$  cm., subcylindrica, apice obtusa, sparse glandulosa, pedunculis plerumque contortis; seminibus numerosis fuscis  $1.5 \times 1$  mm. subcylindricis angulatis.

CAPE PROVINCE.—Hay Division, Wilde-als Put, 16 miles East of Griquatown, frequent on red sand over limestone, fl. & fr. ii.1937, *Wilman* 4075 (K; KMG). Barkly West Division, Silverstreams, fl., 15.iii.1939, *Esterhuysen* 776 (BOL; K). Kuruman Division, Kuruman, limestone, Edmonstone-Sammons 54 (KMG); Cardington, common on surface limestone, fl. iv.i.1940, *Ferrar* s.n. (K; KMG); Cotton End, fl. & fr., iv.1940, *Ferrar* s.n. (K); Cardington, fl. & fr. iv.1940, *Esterhuysen* 2188 (K, type; BOL; PRE) Cotton End, limestone, fl. iv.1940, *Esterhuysen* 2251 (BOL; K; PRE): flowers opening in afternoon.

This species is close to *C. asplenifolius* Burch. but is very distinct because of its pinnatipartite leaves. It appears to be confined to limestone soils and to have a very restricted range of distribution.

#### VERBENACEAE.

**Priva auricoccea** *A. Meeuse* spec. nov., *P. curtisiae* Kobuski arcte affinis sed calycibus fructiferis majoribus sparse minuteque tuberculatis, fructu aurantiaco spinis longioribus horrido praecipue differt.

Suffrutex perennis c. 50 cm. altus e basi ramosus. *Caules* erecti quadrangulati pilis rectis vel subuncinatis puberuli vel hirtelli, demum glabrescentes. *Folia* ovato-oblonga vel subhastato-oblonga, obtusa, crenato-dentata, ad basin abrupte et anguste attenuata, pilis minutis setulosis subscabra, petiolis applanatis hirtellis subnullis vel interdum ad 7 mm. longis. *Racemi* 15-25 cm. longi, subhirtelli, pedicellis infra calycem dilatatis articulatisque post anthesin 1-2 mm. longis, bracteis lanceolatis acuminatis acutissimis 3-4 mm. longis. *Corolla* ignota. *Calyx* fructifer compresso-subglobosus pilis uncinatis subvelutinus, sparse minuteque tuberculatus, 7-9 mm. longus et latus. *Mericarpia* spinis rectis vel leviter curvatis 1-2 mm. longis horrida, fusco-aurea, hirsutopuberula, c. 6 mm. longa, 4 mm. lata, 2.5 mm. crassa.

SOUTH WEST AFRICA.—Kaokoveld: 1.6 m. N.E. of Kaoko-Otavi on road to Ohopoho, *de Winter & Leistner* 5532 (PRE, holo.!).

A perennial herb with tough base about 50 cm. tall, producing several erect and sparingly branched stems from the woody top of the rootstock. *Stems* more or less distinctly quadrangular becoming more terete when passing into the terminal spike-like racemes, rather densely leafy, shortly pubescent to hirsutulous with straight or sometimes more or less distinctly uncinuate hairs, the nodes between the petioles of the opposite-decussate leaves marked with a narrow band of longer stiff hairs. *Leaves* ovate or ovate-oblong to somewhat hastate-oblong, obtuse to rounded at the apex, broadly cuneate to subtruncate at the base, abruptly narrowed at the base into narrow lateral decurrent wings of the up to 7 mm. long, setulose-hispidulous petioles, with a



distinctly but usually not very deeply incised crenate or crenate-serrate margin, apparently rather dark green above, paler beneath, on both surfaces subscabrid through fine setulose-strigose hairs with slightly raised broad base; blade 2·4–5 cm. long and 1·2–3 cm. broad, with a venation (only conspicuous on lower surface, indistinct on upper surface) consisting of a rather slender midrib from which on either side at the base of the blade a usually unequally forked rarely single secondary vein branches off and higher up 3–5 usually unforked ones branch off, connected by rather distant more or less parallel tertiary veins oriented perpendicular to the secondary ones. *Racemes* 15–25 cm. long; the axis a direct continuation of the stem and with the same type of pubescence; pedicels ultimately 1·5–2 mm. long, dilated at the apex into a flat disc-shaped articulation with the calyx; bracts lanceolate-acuminate, setulose, 3–4 mm. long. *Corolla* unknown. *Fruiting calyx* inflated, nearly closed at the orifice, orbicular in outline, laterally compressed, subvelutinous with short stiff greyish-yellow straight to uncinately setose hairs and sparsely tuberculate with blunt or pungent small protuberances, 7–9 mm. long and broad, 3–4 mm. thick. *Fruit* of 2 dry 2-celled cocci (mericarps); cocci spinescent with 1–2 mm. long straight to distinctly curved spines, of a bright golden-brown colour caused by a dense pubescence of minute stiff hairs, with the spines measuring about 6 mm. by 4 mm. by 2·5 mm.

Although flowers are lacking, the plant is clearly a species of *Priva*, a genus whose species are mostly characterised by fruit characters, the flowers being, apart from differences in size and pubescence, rather uniform in structure. In Moldenke's monograph of the genus in Fedde, Repert. 41: 1–76 (1936) it would key out as *P. curtisiae* Kobuski, an East African species, to which it is indeed closely related on account of the cocci being spiny throughout on back and sides and which it also resembles very much in habit, shape and texture of leaves, type of pubescence, "bearded" stem-nodes, etc. but from which it differs in several respects. The petioles are longer, the fruiting calyx and cocci are larger and the spines on the cocci longer and more curved than in *P. curtisiae*, the calyx bears short protuberances (not found in *P. curtisiae*) and the fruit-cocci, which are flat on the commissural surface (not excavated as in *P. curtisiae*), are of a striking golden-brown colour, hence the proposed specific epithet. It is possible that more differences will be found once the flowers of *P. auricoccea* have been collected. Although the differences mentioned may appear to be rather small, they are not smaller than those between some of the other species of long standing in this genus. In view of the urgency in connection with the preparation of the proposed Flora of South West Africa by the workers of the Botanische Staatssammlung at Munich, the description is not delayed for lack of flowers which, in this genus, are not so important for diagnostic purposes as in most other genera.









# Homonyms in the Prodromi of Thunberg and Burman

by

J. E. Dandy

I was asked by the Division of Botany, Pretoria, to give an opinion concerning the status of the name *Cestrum venenatum* used by Thunberg in his *Prodromus* (1794), the question being whether this was intended to be the name of a new species, or whether Thunberg was simply adopting the already existing name *C. venenatum* Burm. f. (1768). The two works concerned are Thunberg's *Prodromus Plantarum Capensium* (1794, 1800) and N. L. Burman's *Florae Capensis Prodromus* appended to his *Flora Indica* (1768). Investigation of these showed that there are a number of cases similar to that of *Cestrum venenatum*, and I therefore thought it advisable, before forming an opinion, to carry out a comparative analysis of all the specific names published in the two *Prodromi*. Following are the results.

Thunberg dedicated his *Prodromus* to N. L. Burman but this is apparently a mark of appreciation of and gratitude for help and encouragement given by Burman, *not* a reference to Burman's own published work on the Cape flora. In fact Thunberg nowhere in his *Prodromus* makes any direct reference to Burman's *Prodromus*, and the only mention of N. L. Burman in the text is on p. 108 where he is cited under *Heliophila* in connexion with a description of that genus published in a Swedish journal. The other references to "Burm." given by Thunberg (e.g. on pp. 97, 98) are to the pre-Linnaean work of J. Burman, the elder. On the other hand, Thunberg throughout his *Prodromus* cites various Linnaean works, with which he was obviously familiar, and also makes occasional references to post-Linnaean publications by Bergius, L'Héritier, Sparrman, Cavanilles, Smith, Jacquin, Delaroche, Houttuyn and Acharius (lichens).

N. L. Burman in his *Prodromus* published about 260 legitimately named new species from the Cape, usually providing a description of his own but sometimes citing an earlier one. It is noteworthy that only 22 of the names listed by Thunberg correspond (in form, at least) with new specific names published by Burman in his *Prodromus*. They can conveniently be listed as follows, each with the Thunberg page-number and then the Burman page-number in parentheses:

<i>Gladiolus junceus</i> 8 (2)	<i>Schoenus spicatus</i> 16 (3)
<i>Echium spicatum</i> 33 (4)	<i>Echium hispidum</i> 33 (5)
<i>Erica hispida</i> 70 (11)	<i>Cestrum venenatum</i> 36 (5)
<i>Ononis prostrata</i> 129 (21)	<i>Vitis capensis</i> 44 (7)
<i>Othonna linifolia</i> 167 (29)	<i>Lineum aethiopicum</i> 68 (11)
<i>Satyrium cornutum</i> 5 (30)	<i>Reseda capensis</i> 85 (13)
<i>Polygala stipulacea</i> 121 (20)	<i>Orobanche capensis</i> 97 (17)
<i>Lobelia volubilis</i> 39 (29)	<i>Geranium ovale</i> 113 (19)
<i>Aloe arachnoides</i> 61 (10, "arachnoidea")	<i>Ononis strigosa</i> 130 (21)
	<i>Phaseolus capensis</i> 130 (21)
	<i>Psoralea linearis</i> 135 (22)
	<i>Gnaphalium spathulatum</i> 151 (25,
	"spatulatum")
	<i>Osteospermum incanum</i> 166 (29)

Of these, *Gladiolus junceus* is *G. junceus* L. f. (1781), non Burm. f.; *Echium spicatum* is *E. spicatum* L. f. (1781), non Burm. f.; *Erica hispida* is *E. hispida* Thunb. (1785), non Burm. f.; *Ononis prostrata* is *O. prostrata* (L.) L. (1771), non Burm. f.; *Othonna linifolia* is *O. linifolia* L. f. (1781), non Burm. f. *Satyrium cornutum* is *S. cornutum* (L.) Thunb., a new combination based on *Orchis cornuta* L., which has no connexion with *S. cornutum* Burm. f. *Polygala stipulacea* is evidently taken up from Linnaeus, Mant. Pl. Alt. 260 (1771), where Linnaeus makes an interpretation of *P. stipulacea* Burm. f. Similarly *Lobelia volubilis* is taken up from Linnaeus fil., Suppl. Pl. 396 (1781), where an interpretation is made of *L. volubilis* Burm. f. *Aloe "arachnoides"* is *A. arachnoidea* (L.) Burm. f., this being Linnaeus's *A. pumila* var. *arachnoidea* which was raised to specific rank in 1768 both by Burman and (probably later) by Miller, Gard. Dict., ed.8: the spelling *A. "arachnoides"* was used by Thunberg in one of his earlier works (Diss. Bot.-med. Aloe, 7) in 1785.

Thus only the 13 names in the right-hand column above have to be considered, and it is at once notable that they all have common-place epithets which might occur to any author coining names for new species. Furthermore, Thunberg's descriptions of these species all differ more or less from those given (or referred to) by Burman for his species, and while Thunberg was in the habit of remodelling descriptions (even for Linnaean species) the differences in some cases are so striking that it is difficult to believe that he is referring to Burman's species. For example:

*Psoralea linearis* Burm. f.: "foliis simplicibus . . . floribus terminalibus ternis".  
*Psoralea linearis* Thunb.: "foliis ternatis . . . floribus lateralibus solitariis".

*Ononis strigosa* Burm. f.: "floribus axillaribus sessilibus".  
*Ononis strigosa* Thunb.: "umbellis terminalibus".

*Limeum aethiopicum* Burm. f.: "foliis ovato oblongis".  
*Limeum aethiopicum* Thunb.: "foliis lineari-lanceolatis".

From the above we have the following points:

- (1) Thunberg nowhere refers directly to Burman's *Prodronus*.
- (2) Only very few of Thunberg's names coincide with names proposed by Burman and not used by any other author.
- (3) Of these few, all have common-place epithets and all have descriptions differing (sometimes fundamentally) from Burman's.

My conclusion is that none of Thunberg's names (except *Polygala stipulacea*, and *Lobelia volubilis* which he adopted through Linnaean works) can be accepted as an application of a new Burman name; and that all the names listed in the right-hand column above, including *Cestrum venenatum*, are to be regarded as illegitimate later homonyms published as new by Thunberg.

# South African Labiatae

by

L. E. Codd

## THORNCROFTIA

The genus *Thorncroftia* was described by N. E. Brown in Kew Bull. 1912:281 and was based on *T. longiflora* N.E.Br., which he described at the same time. Only one specimen was cited, namely: "Transvaal, among rocks near Barberton, 1220 m, *Thorncroft* 795". Two specimens in the Transvaal Museum Herbarium (now incorporated in the National Herbarium, Pretoria), collected by George Thorncroft, supply additional information. On No. 795 the label states: "Herb, 2 ft., flowers pink, found among sandstone rocks, Joe's Luck near Barberton, alt. 4,000 ft., April 1911"; and on a second gathering without number: "Joe's Luck footpath near Barberton, on sandstone rocks, alt. 4,000 ft., May 1913".

The only other material of the species known until recently is a plant cultivated by the Cambridge Botanic Garden from seed sent by Thorncroft, and figured for the Botanical Magazine, t. 8824 (1919). In order to evaluate the plant as to generic status, it was felt that more material was required and the assistance was enlisted of Barberton residents, including George Thorncroft's son, Mr. J. N. Thorncroft, and grandson, Mr. N. G. Thorncroft.

In George Thorncroft's time a flourishing settlement existed in the mountains some miles to the north-east of Barberton, called Eureka City, which boasted of amenities attractive to inhabitants of the neighbourhood. Joe's Luck is the name of a mine nearby and a railway siding in the low country at the foot of the mountains, and it is reported that a well-used footpath connected the latter with Eureka City some 2,000 feet higher in altitude. At present, however, very little is left of Eureka City and the footpath cannot be traced with certainty. Thus more than a year passed before Mr. and Mrs. P. F. Clarke and Mr. N. G. Thorncroft found the species in the mountains above Joe's Luck Siding, probably not far from the type locality.

During their searches in the environs of Barberton, Mr. and Mrs. Clarke collected two species which were clearly closely allied to *Thorncroftia longiflora*, and one of these was again collected near Barberton by the late Prof. Werdermann of Berlin, during his recent visit to South Africa. Further study revealed that these two species had been described in the genus *Plectranthus*, as *P. thorncroftii* S.Moore and *P. succulentus* Dyer and Bruce. The opportunity is now taken to transfer them to *Thorncroftia*.

Although the three species now in *Thorncroftia* superficially resemble *Plectranthus* or *Orthosiphon*, they possess characters which clearly place them in a distinct genus. These characters are: (a) the flowers are borne singly in the axils of the bracts, not in several-flowered verticils; (b) the bracts are not clearly differentiated from the leaves, but grade into the upper leaves on the flowering shoot; and (c) the corolla, although obscurely bilabiate is, in fact, 4 lobed, comprising a lower, entire, boat-shaped lip, an erect upper emarginate lobe and two lateral, narrowly oblong lobes which are deflexed in the open flower and spread on each side of the lower lip. This may represent a more primitive state than in *Plectranthus* and *Orthosiphon*, where the lateral lobes are apparently fused with the upper, producing a more or less obscurely 4-lobed upper lip, while the lower boat-shaped lip remains much the same.

In some minor respects the generic description of *Thorncroftia* must be modified to accommodate the two additional species. For instance, the upper calyx lobe may or may not be decurrent on the tube, and the corolla tube may be short or long.

The basic chromosome number in *Thorncroftia* appears to be  $n = 7$ , as in *Plectranthus* and *Orthosiphon*, judging by the number  $2n = 28$  recorded for *T. succulentus* by de Wet in S.A. Journ. Sci. 54:153 (1958). Another point of general interest is that the three species of *Thorncroftia* are almost invariably parasitised by a weevil, *Apion* sp., which causes thickened swellings in the succulent stems. It is not known how specific this weevil is, but very rarely are *Plectranthus* specimens seen with these swellings and *Orthosiphon* not at all.

Plants up to 25 cm tall; corolla tube less than 1 cm long..... 1. *T. thorncroftii*.  
Plants 30–120 cm tall; corolla tube 1.5–3.8 cm long:

Inflorescence relatively lax; corolla tube 3.4–3.8 cm long; pubescence consisting of simple or multicellular, not dendroid hairs..... 2. *T. longiflora*.  
Inflorescence compact; corolla tube 1.5–2 cm long; dendroid hairs present, mixed with simple and multicellular straight hairs..... 3. *T. succulentus*.

1. *T. thorncroftii* (S. Moore) L. E. Codd. comb. nov.

*Plectranthus thorncroftii* S. Moore in Journ. Bot. 56:39 (1918). Type: Barberton. *Thorncroft* in Rogers 16987 (BM, holo., PRE, iso.). On the PRE specimen the number has been altered to 14987.

Succulent herb 10–25 cm high; stem erect, sparingly branched, about 8 mm in diameter at the base, tapering to 4 mm in diameter above, pubescent with glandular, simple and scattered multicellular hairs. Leaves opposite, shortly petioled, obovate to oblong-obovate, 1.5–2 cm long and 6–8 mm broad, fleshy, drying subcoriaceous, thinly pubescent and glandular on both surfaces, cuneate at the base, apex rounded; margin sparingly crenate-dentate in the upper third; pubescence mainly of multicellular, unbranched hairs. Inflorescence a raceme or sparingly branched panicle 5–8 cm long; bracts opposite, leaflike, up to 6 mm long below, becoming progressively smaller and narrower above to about 3 mm long; flowers solitary in the axil of each bract, pedicels 3–6 mm long, glandular puberulous. Calyx 5-toothed, glandular puberulous, obscurely 2-lipped, 3–3.5 mm long in flowering stage increasing to 7 mm long in fruit, tube campanulate; the upper tooth the largest, ovate-deltoid, decurrent on the tube, the lower 4 subequal, lanceolate- to linear-triangular. Corolla whitish with purplish spots on the upper lobe, obscurely bilabiate, sparingly pubescent without; tube campanulate, expanding abruptly from the calyx, 4.5–5 mm long and 2.5–3 mm broad; upper lip erect, sub-orbicular, emarginate, 6 mm long and equally broad; two lateral lobes oblong, 3–4 mm long, deflexed; lower lip boat-shaped horizontal, 6–7 mm long. Stamens 4 exserted; filaments free, up to 6 mm long. Ovary 4-lobed, glabrous; style slender, exserted; stigma shortly bifid.

Found among rocks in mountain grassland. Known so far only from the mountain massif between Barberton and Havelock Mine.

TRANSVAAL.—Barberton: *Thorncroft* in Hb. Rogers 16987 (or 14987); Havelock road, growing among rocks and grass on koppie near Angle Station, alt. 5,000 ft., 24th March, 1956, Clarke 41; between Barberton and Piggs Peak, Werdermann 2197.

This species has a short corolla tube and the corolla bears a superficial resemblance to certain species of *Plectranthus*, e.g. *P. thunbergii*, as remarked by Spencer Moore. However, it has the essential features of *Thorncroftia*, namely the four-lobed corolla, solitary flowers in the axils of the bracts and the rather leaflike bracts. The upper calyx tooth is decurrent on the tube as in *Orthosiphon*.

2. *T. longiflora* N.E.Br. in Kew Bull. 281 (1912); Prain in Bot. Mag. t.8824 (1919).

Type: Transvaal, Barberton, *Thorncroft* 795 (K, holo., PRE, iso.).

Succulent herb or soft shrublet 30–60 cm high; stems several, arising from a thickened rootstock about 4 cm in diameter, 1 cm in diameter at the base, tapering to 4–5 mm in diameter above, sparingly branched, densely and shortly grey tomentose;



pubescence of simple and multicellular unbranched hairs. *Leaves* opposite, shortly petiolate, elliptic to obovate, 1–2 cm long and 4–10 mm broad, cuneate at the base, apex rounded, entire or faintly crenate-dentate in the upper third, densely short tomentose and pitted with sessile glands on both surfaces. *Inflorescence* a panicle; racemes 3–9 cm long, densely glandular puberulous; bracts opposite, leaflike, up to 1.2 cm long below, becoming progressively smaller and narrower above to about 2.5 mm long; flowers solitary in the axil of each bract; pedicels 2.5–4 mm long, glandular puberulous. *Calyx* 5-toothed, glandular puberulous, obscurely 2-lipped, the upper tooth the largest, ovate-deltoid, acute, decurrent on the tube, the lower 4 subequal, lanceolate-triangular, acuminate. *Corolla* pink to mauve pink with deeper flecks on the lateral lobes, obscurely bilabiate, glandular and sparingly pubescent without; tube narrowly cylindrical, straight, 3.4–3.8 cm long and 1–1.5 mm broad; upper lip erect, oblong, emarginate, 7–8 mm long and 4–5 mm broad; two lateral lobes narrowly oblong 5–6 mm long and 1.5 mm broad, deflexed; lower lip narrowly boat-shaped, horizontal, 6–7 mm long. *Stamens* 4, exserted; filaments free, 6–7 mm long. *Ovary* 4-lobed, glabrous, style slender, exserted; stigma shortly bifid.

Found in crevices on relatively bare rock outcrops. Evidently rare and localised in mountains north-east of Barberton.

TRANSVAAL.—Barberton: Joe's Luck footpath, April, 1911, *Thorncroft* 795; May, 1913, *Thorncroft* in TM 12775; March, 1957, *Thorncroft* and *Clarke* s.n.

3. *T. succulentus* <sup>a</sup> (*Dyer and Bruce*) *L. E. Codd*, comb. nov.

*Plectranthus succulentus* Dyer and Bruce in Flow. Pl. Afr. 27:t.1073 (1949). Type: Soutpansberg, Entabeni, *Loock* in PRE 27461 (PRE, holo.).

Succulent herb or shrub 60–120 cm high; stems several arising from a thickened rootstock 3–6 cm in diameter, 0.7–1.5 cm in diameter at the base and tapering to 4–5 mm in diameter above, sparingly branched, densely and shortly grey tomentose. *Leaves* opposite, shortly petiolate, ovate-elliptic or obovate 1.6–3 cm long and 1.5–2 cm broad, cuneate or obtuse at the base, apex rounded, crenate in the upper two-thirds, thinly to densely tomentose and glandular on both surfaces; pubescence consisting of branched and unbranched multicellular or simple white hairs. *Inflorescence* a congested racemose panicle 8–14 cm long, glandular and hispid with dendroid hairs; racemes 2.5–4 cm long; bracts opposite, somewhat leaflike, ovate and 1.2 cm long below, becoming progressively smaller and narrower above to about 5 mm long and 2–3 mm broad; flowers solitary in the axil of each bract; pedicels 0.5–2 mm long, pubescent. *Calyx* 5-toothed, with scattered glands and dendroid hairs, obscurely 2-lipped, the upper tooth somewhat larger than the rest, ovate-deltoid, acuminate, not obviously decurrent on the tube, the lower 4 subequal, lanceolate-triangular, acuminate. *Corolla* pale lilac with darker spots on the upper and lateral lobes, obscurely bilabiate, glandular and sparingly pubescent without; tube narrowly cylindrical, straight, 1.5–2 cm long and 1.5–2 mm in diameter; upper lip erect, ovate-oblong; emarginate, 6–8 mm long and 5–7 mm broad; two lateral lobes narrowly oblong, 5–6 mm long and 1 mm broad, deflexed; lower lip narrowly boat-shaped, 5–6 mm long, at first horizontal and later reflexed. *Stamens* 4, exserted; filaments free, 3–4 mm long. *Ovary* 4-lobed, glabrous; style slender, exserted; stigma shortly bifid.

Occurs among rocks or in crevices of bare rock outcrops in mountains of eastern and northern Transvaal.

TRANSVAAL.—Soutpansberg: Soutpansberg Mountains, Entabeni, *Loock* in PRE 27461; *Bruce and Kies* 7; *Codd* 4194; Summit of Franzhoek Peak, *Galpin* 14881; Hangklip, *Gerstner* 5903; *McKay* s.n.; *Meeuse* 10163; 20 miles W. of Mountain Inn, *Meeuse* 9787; Wylliespoort, *Breyer* in TM 19451. Pilgrimsrest: Drakensberg escarpment opposite Mariepskop, *Codd* 7904. Barberton: Hyslop's Creek, *Clarke* 213.

## THE COLEUS CANINUS COMPLEX

*Coleus neochilus* (Schltr.) L. E. Codd, comb. nov.

*Plectranthus neochilus* Schltr. in J. Bot. Lond. 34: 394 (1896); Cooke in Fl. Cap. 5, 1: 285 (1910). Type: Transvaal, near Barberton, *Galpin* 968 (GRA, NH, iso.).

*Coleus schinzii* Guerke in Bull. Herb. Boiss. 6: 555 (1898); Bak. in Fl. Trop. Afr. 5: 430 (1900). Type: S.W. Africa, Ovamboland, Tsumeb, *Schinz* 56 (Z, holo., PRE, photo.). *C. pentheri* Guerke in Ann. Naturhist. Hofmus. Wien, 20: 48 (1905); Cooke in Fl. Cap. 5, 1: 289 (1910); Bruce in Hook. Ic. Pl. 34: t.3375 (1938). Type: Cape Province, Peddie District, Breakfast Vlei, *Krook* in Hb. Panther 1716 (W, holo., PRE, iso.). *C. carnosus* Dinter, ined.; Eljovson, S.A. Flow. for the Garden, 165 (1955) nom. nud.; non Hassk. nec A. Chev.

Found in relatively dry bushveld, or occasionally among rocks in moister grassland, in the eastern Cape Province, Natal, Transvaal, S.W. Africa and Rhodesia.

CAPE.—Peddie: Breakfast Vlei, *Krook* in Hb. Panther 1716. East London: Kintza River Mouth, *Galpin* 6554. Stutterheim: Kabaku Hills, *Acocks* 9547. Komgha: *Flanagan* 557.

NATAL.—Pietermaritzburg: Thornville Junction, *Chapman* 1368. Weenen: 1 mile W. of Muden, *Codd* 8602.

TRANSVAAL.—Carolina: Waterval Boven, *Rogers* 14485. Barberton: near Barberton, *Galpin* 968 (GRA, NH); *Codd* 9531; on Lebombo Range, near Kobinja, *Codd* 7798. Pilgrim's Rest: near Graskop, *Galpin* 14433; near Vaalhoek, *Meeuse* 10013. Lydenburg: Sekukuniland, *Barnard* and *Mogg* 704. Pietersburg: *Munro* in TM 15282. Potgietersrus: *Rogers* 4817; *Comins* 917. Waterberg: Towoomba Research Station, *Sidey* 1401. Pretoria: Rietvlei Research Station, *Acocks* 11262; 13 miles S.E. of Pretoria, *Codd* 2570; Quaggapoort, *Verdoorn* s.n.; near Saltpan, *Pole Evans* 4775; 10½ miles N. of Hammanskraal, *Codd* 9385. Rustenburg: 19 miles S. of Northam, *Codd* 8632. Marico: near Zeerust, *Jenkins* in TM 13219; *Leistner* 349. Lichtenburg: *Jenkins* in TM 13220; *Sutton* 365.

S.W. AFRICA.—Ovamboland: Tsumeb, *Schinz* 56 (Z). Grootfontein: *Schoenfelder* 5643; near Otavi, *Dinter* 5634; *de Winter* 2853.

S. RHODESIA.—Intabazinduna Reserve, *Davies* 19. Inyanga Village, *Wild* 3853. Matobo: Bulawayo, *Rogers* 5933; 13657; Bima Kobila, *Miller* 2054; Matopos Research Station, *Plowes* 1388. Mrewa: near Shawanoe, *Leach* 8084.

I am indebted to the Director of the Natural History Museum, Vienna, for presenting the National Herbarium, Pretoria, with a portion of the type of *C. pentheri* Guerke, and to the Director of the Zurich University Herbarium for sending us the type of *C. schinzii* Guerke on loan. These were compared with material of the type gathering of *Plectranthus neochilus* Schltr. (*Galpin* 968 in NH and GRA) and are considered to be conspecific. The differences between the three types are mainly in habit and pubescence, characters which vary a good deal in this group. In the eastern Cape Province, the stems are semi-prostrate to decumbent, about 10–20 cm long, with numerous glands and short, dense, adpressed pubescence on leaves and stems and scattered long, multicellular hairs on the stems. In the Transvaal, S.W. Africa and Rhodesia, the stems are more ascending, 30–45 cm high, and usually more conspicuously villous, though sometimes possessing only the glandular and adpressed pubescence. There is some indication that the plants may behave as annuals in South West Africa, though this requires investigation. Elsewhere the plants are perennial, often with somewhat tuberous roots in the young stage. The leaves are usually obovate to elliptic-ovate, faintly crenate at the rounded or obtuse apex and narrowly cuneate at the base. The inflorescence characters are relatively constant. In the bud stage, the inflorescence is a 4-angled spike 3–4 cm long, composed of 4 rows of densely imbricate, ovate, acuminate bracts.

The bracts are shed as each verticil of flowers starts to open. As flowering proceeds, the rhachis elongates, with the result that the verticils become separated by intervals of 5–15 mm, producing an interrupted spike of up to 15 cm long. Depending on the length of the inflorescence, 5–12 spaced verticils may be seen below the coma of bracts, the uppermost 3 or 4 still flowering and the lower ones in fruit, with the rhachis easily visible between the verticils. The corolla is usually about 1·5 cm long, varying from 1·2–1·8 cm. The lower lip is large and boat-shaped, purple to violet, while the upper lip is erect, small, whitish, mottled with bluish-purple.

Two closely related species, both of which bear epithets older than *C. neochilus*, must be taken into consideration, namely, *C. caninus* (Roth) Vatke (syn. *C. spicatus* Benth.) and *C. comosus* Hochst. ex Guerke. There seem to be adequate reasons at present for maintaining the three as distinct, though the tropical material seen is admittedly scanty. It is possible that when more good material becomes available from tropical territories the position should be reviewed again. In any case, the following notes will act as a guide to the characters to which collectors should give attention.

Both *C. caninus* and *C. comosus* can usually be separated from *C. neochilus* by their shorter, denser inflorescences. As the inflorescences start to flower they elongate slightly, but not to the extent of *C. neochilus*, so that the verticils do not become separate, except perhaps the lowest one or two. Even when flowering is well advanced, the spike is usually 3–5 cm long, rarely up to 9 cm long. The corolla in *C. caninus* is shorter than in *C. neochilus*, rarely exceeding 1 cm long, while in *C. comosus* it is usually longer than in *C. neochilus*, being 2–2·5 cm long. Usually in drying specimens the corolla becomes shrivelled or distorted, making measurements difficult.

*C. caninus* was described from India, and herbarium specimens were kindly sent on loan to us by the Forest Research Station, Dehra Dun, Pakistan. Specimens matching the Indian material have been seen from Kenya, Tanganyika, Rhodesia and South West Africa. Seed was extracted from one specimen received from the latter territory (*Sachs* 2) and the resulting plants in cultivation behaved as annuals. It is also fairly definite that *Wild* 4544 from Rhodesia and *Greenway* 9190 from Tanganyika are annuals. Whether all material referable to *C. caninus* is of annual habit is not known; if this proves to be the case, it would be an additional useful character for separating it from the predominantly perennial species, *C. comosus* and *C. neochilus*. Although no material has been seen of the type gathering of *C. omahekeensis* Dinter, it seems clear from the somewhat scanty description that it is conspecific with the *Sachs* specimen, and so *C. omahekeensis* is included in synonymy under *C. caninus*. The leaves of *C. caninus* are relatively long in relation to their width, being ovate-lanceolate to long-elliptic or oblanceolate, sparingly crenate-dentate in the upper half, acute to obtuse at the apex and long-cuneate at the base. As may be expected, there is considerable variation in stature and leaf size according to growing conditions.

*C. comosus* is essentially a plant of north-east Africa, chiefly Kenya and Abyssinia, and specimens have not been seen from territories south of Kenya. The possibility exists that it extends to Arabia. It is a perennial and, like *C. neochilus* and *C. caninus*, the leaves are aromatic and fleshy. In general the leaves are broadly obovate, faintly to distinctly crenate at the rounded apex and cuneate at the base. The flower spike is short, rarely becoming lax at the base and is borne usually on a long, slender, leafless rhachis.

The more important citations for *C. caninus* and *C. comosus* are set out for convenience below.

*C. caninus* (Roth) Vatke in *Linnaea* 37: 318 (1871), partly, excl. specimen cited; Guerke in *Bot. Jahrb.* 19: 212 (1895). Type: India, *Heyne* s.n.  
*Plectranthus caninus* Roth, *Nov. Pl. Sp.* 279 (1821).

*Coleus spicatus* Benth. in Wall. Pl. As. Rar. 2: 15 (1831); Wall. Cat. 2729 (1831); Benth. in DC. Prodr. 12: 71 (1848); Wight, Ic. t. 1431 (1849). Type: India, Wight s.n. in Hb. Benth. *C. omaheakensis* Dinter in Fedde Rep. Beih. 53: 123 (1928), ex descr. Syntypes: S.W. Africa, Grootfontein, Etimba, Dinter 3265; Otjikuara, Dinter 3265.

Found in India, east tropical Africa to Rhodesia and South West Africa.

S.W. AFRICA.—Grootfontein: Farm Kakuse, east of Etosha Pan, and plants cultivated in Pretoria from seed obtained from this gathering, Sachs 2.

S. RHODESIA.—Hartley: Poole Farm, Wild 4544.

TANGANYIKA.—Kilimanjaro, Greenway 6897.

KENYA.—Nairobi, Verdcourt and Greenway 399.

*C. comosus* Hochst. ex Guerke in Bot. Jahrb. 19: 212 (1894); Bak. in Fl. Trop. Afr. 5: 426 (1900); Bruce in Hook. Ic. Pl. 34: t.3374 (1938). *C. comosus* Hochst. in A. Rich., Tent. Fl. Abyss. 2: 183 (1851), in synonymy. *C. spicatus* [non Benth.], A. Rich., l.c. *C. caninus* [non (Roth) Vatke], Vatke in Linnaea 37: 318 (1872). Type: Abyssinia, Schimper 1328.

Specimens seen include the following: a plant cultivated in Pretoria, collected by Dr. P. J. Greenway near Nairobi: Codd 8238, a plant of unknown origin, cultivated in gardens in South Africa; Gillett 14080 and 14312 collected with the Kenya-Ethiopia Boundary Commission; and probably Williams 637 from Nairobi, though the flowers of this specimen appear smaller than usual.

The main characters which may be used in separating the three species are summarised below:—

*C. neochilus*. Plants perennial; leaves obovate to elliptic-ovate, faintly crenate at the rounded or obtuse apex; flower spike 7–15 cm long, lax with 5–12 spaced verticils below the coma of bracts; corolla 1·2–1·8 cm long.

*C. comosus*. Plants perennial; leaves usually broadly obovate, faintly to distinctly crenate at the rounded apex; flower spike 3–5, rarely up to 9 cm long with one or two, rarely more, spaced verticils at the base; corolla 2–2·5 cm long.

*C. caninus*. Plants annual or, possibly, perennial; leaves ovate-lanceolate, long elliptic or oblanceolate, sparingly crenate-dentate in the upper half, apex acute to obtuse; flower spike 2–5, rarely up to 9 cm long, dense at the base; corolla 0·8–1 cm long.



# South African Species of *Satureia*

by

D. J. B. Killick.

## SATUREIA

*Linn.*, Sp. Pl. ed. 1: 567 (1753), Gen. Pl. ed. 5: 247 (1754); Briquet in Engl. and Prantl. Nat. Pflanzenfam. 4, 3a: 296 (1896). *Micromeria* Benth. in Bot. Reg. 15: sub t. 1282 (1829).

The genus *Micromeria* was described by Bentham (1829), who distinguished it from *Satureia* on the grounds that the calyx was 13–15 instead of 10-nerved. Baker in Flora of Tropical Africa 5, 453 (1900) and Skan in Flora Capensis 5, 1: 306 (1912) in their treatments of Labiatae both upheld *Micromeria*. Briquet, however, reduced *Micromeria* to a synonym of *Satureia* explaining that the calyx nerves very often divide and that intermediate species made delimitation of the two genera impossible. Later taxonomists, for example Thonner, Flowering Plants of Africa, 479 (1915), Brenan in Mem. N. Y. Bot. Gard. 9, 1: 45–53 (1954) and now Hedberg, Afroalpine Vascular Plants, 160–164 and 317–318 (1957) have followed Briquet's classification. Until a critical revision of *Satureia* and related genera is undertaken, it seems desirable for the sake of uniformity in Africa, to follow recent workers and place our species under *Satureia*. The necessary name changes are made in this paper.

The generic name was originally spelled *Satureja* by Linnaeus, but the spelling *Satureia* is more correct philologically and is used here in accordance with Art. 74 (2) of the International Code of Botanical Nomenclature (1956).

- Bracts foliose..... 1. *S. grandibracteata*.  
 Bracts linear:  
 Calyx tubular..... 2. *S. biflora*.  
 Calyx campanulate:  
 Lower lip of corolla longer than upper..... 3. *S. reptans*.  
 Lower lip equal or shorter than upper..... 4. *S. compacta*.

### 1. *S. grandibracteata* Killick, nom. nov.

*Micromeria grandiflora* Killick in Bothalia 6, 2: 439–440 (1954). Type: Cathedral Peak Forest Influences Research Station, Killick 1684 (PRE, holo.).

The epithet *grandiflora* cannot be used, because it is pre-occupied in *S. grandiflora* Scheele (1843).

For a description of *S. grandibracteata* see Killick (l.c.). No additional specimens of this species have been received since it was first described.

NATAL.—Bergville: Cathedral Peak Forest Influences Research Station Codd and Dyer 6241; Killick 1102, 1600, 1684.

2. *S. biflora* (Buch. Hamilt. ex D. Don) Briq. in Engl. and Prantl., Nat. Pflanzenfam. 4, 3a: 299 (1896). Type: Upper Nepal, Suemba, Hamilton s.n. (not located).  
*Thymus biflorus* Buch. Hamilt. ex D. Don, Prodr. Fl. Nepal, 112 (1825). *Micromeria biflora* (Buch. Hamilt. ex D. Don) Benth., Lab. Gen. et Sp. 378 (1834).

A shrubby herb with numerous ascending branches, 20–60 cm high, pubescent, glandular-punctate; internodes 0.5–3 cm long. *Leaves* subsessile, narrowly elliptic to broadly ovate, 5–15 mm long, 1.5–10 mm wide, apex acute to obtuse, base broadly cuneate to round, entire. *Cymes* 1–9 flowered; peduncles 2–7 mm long, bibracteate; bracts linear, 1.5–2 mm long. *Calyx* tubular, 15-nerved; tube 2–3 mm long; teeth subequal, elongate-triangular, acuminate, somewhat spinous and reflexed. *Corolla* white or mauve: tube 5–6 mm long; upper lip emarginate, 1.5 mm long, 2 mm wide; lower lip 3-lobed, 4 mm long, 4–5 mm wide, lateral lobes rounded, middle lobe emarginate. *Stamens* didynamous, arcuate, upper 1 mm long, lower 2 mm long; anthers 2-celled, divaricate. *Disc* slightly lobed. *Style* included, 5 mm long; stigma bifid, lobes subequal. *Nutlets* oblong, 1 mm long, 0.5 mm wide.

BASUTOLAND.—Quthing: Moyeni Mountain, Lelvaleng, *Dieterlen* 1346.

CAPE.—Engcobo: Emgwali River, *Flanagan* 2809. Herschel: Sterkspruit, *Hepburn* 5. Umtata: Baziya, *Baur* 220; Nqadu woods, *Pegler* 1575.

TRANSVAAL.—Barberton: Lomati, *Thorncroft* 2115. Heidelberg: *Mogg* 24170. Krugersdorp: *Mogg* 23161. Lydenburg: Kantoorbos, *Codd* 9787. Pietersburg: Duivelskloof, *Galpin* 10101, 11393. Pretoria: Leikenhoutsloof, *Mogg* 12433. Roodepoort: Roodepoort Ridge, *Mogg* 20254. Rustenburg: Farm Morgenzon, *Rose-Innes* 122. Soutpansberg: Louis Trichardt, *Letty* 247. District Unknown: Valdesia, *Schlechter* 4534.

*S. biflora* is an extremely variable species as regards leaf-shape, number of flowers and structure of calyx. It is here treated in its widest sense, following Baker (l.c. 452) who regarded the Tropical African species *S. punctata* (Benth.) Briq., *Micromeria ovata* Benth., *M. schimperii* Vatke and *M. purtschelleri* Gürke as synonyms. Subsequent workers have variously upheld these species. For example, Brenan (l.c. 45) considered *S. punctata* as distinct, likewise Hedberg (l.c. 161). Recently E. and K. Walther in Mitt. Thür. Bot. Gesell. 1, 4: 1–12 (1957) in a very detailed study of *S. biflora* and its allies upheld all the species sunk by Baker. According to these two workers typical *S. biflora* is restricted to the Himalayas and Eastern India and does not occur in Africa, but they allow for the presence in Africa of two of its varieties, namely var. *rhodesiaca* Walther and var. *villosa* Walther.

The problem was submitted to Mr. W. Marais our liaison officer at Kew who, together with Mr. P. Taylor of that institution, examined type material and specimens at Kew and the British Museum. Taking the whole range of material into consideration they decided that there was no justification whatever for upholding the species and varieties regarded by E. and K. Walther as distinct.

### 3. *S. reptans* Killick, nom. nov.

*Micromeria pilosa* Benth. in Hook. Icon. Plant. 15: t. 1522 (1886). Types: Faku's Territory, Sutherland s.n.; Natal, Medley Wood 3712 (both K).

Prostrate aromatic herb with slender branches up to 2 ft. 6 in. long, covered with numerous silvery multicellular hairs and a few unicellular gland-tipped hairs, glandular-punctate; internodes 1–5 cm long. *Leaves* ovate, 0.7–2.5 cm long, 0.6–2.0 cm wide, apex acute to rounded, base shallowly cordate to broadly cuneate, margins crenate with few teeth; petioles 1–5 mm long. *Flowers* 1–2 in axils of uppermost leaves (rarely 3, *Galpin* 11745). *Pedicels* threadlike, 0.7–3 cm long, bibracteate about the middle; bracts linear, 1–2 mm long. *Calyx* campanulate, 15-nerved; tube 2.5–4 mm long, teeth subequal, deltoid, 1–2 mm long. *Corolla* “white” (*Galpin* 11745 and 11925) to pale cobalt violet, often creamy yellow on lower side; tube 0.5–1.2 cm long, 3–7 mm wide at mouth, pilose and yellow inside on lower side; upper lip emarginate, 1–2 mm long, 3–6 mm wide; lower lip 3-lobed, middle lobe emarginate, 4–7 mm long, 3–7 mm wide, lateral lobes round, 2–3 mm diam. *Stamens* 4, didynamous, arcuate, lower 3 mm long, upper 1.5 mm long. *Disc* slightly lobed. *Style* 1 cm long, the posticous lobe the shorter. *Nutlets* oblong, 2 mm long, 1 mm wide.

NATAL.—Bergville: Cathedral Peak Forest Station, *Killick* 1272, 1429. Estcourt: Cathkin Peak, *Galpin* 11745; Bushmans River, *Medley Wood* 10894. Lions River: Lidgetton, *Mogg* 6890. Richmond: Byrne, *Galpin* 11925. Underberg: Bamboo Mountain, *McLean* 709.

A new name is necessary in *Satureia*, because of the existence of *S. pilosa* Velen. (1899) described from Bulgaria.

4. *S. compacta* Killick, sp. nov., *S. reptanti* Killick et *S. grandibracteatae* Killick affinis, ab ambabus habitu multo compaciore corollae labio antico quam posticum aequilongo vel brevior facile distinguitur.

*Herba* prostrata compacta multo ramosa glanduloso-punctata pilis multicellularibus induta, internodiis 5–15 mm longis. *Folia* late ovata vel rotunda 0·5–1·1 cm longa, 0·4–1·0 cm lata, apice et basi rotunda, marginibus breviter crenatis, petiolis 2–4 mm longis. *Flores* in axillis foliorum solitarii. *Pedicelli* 3 mm longi infra medium bibracteati; bractae lineari-lanceolatae 1·5 mm longae carinatae. *Calyx* campanulatus 15-nervis, tubo ad 2 mm longo, lobis aequalibus triangulari-lanceolatis c.2 mm longis. *Corolla* cobalto-violacea intus glabra; tubus anguste campanulatus 5 mm longus, labio antico 3-lobato lobis lateralibus rotundis 2 mm diam. lobo medio emarginato 2 mm longo 2–5 mm lato, labio postico emarginato 2 mm longo 3 mm lato. *Stamina* didynama, antica 3 mm longa, postica 2 mm longa, antheris 2-locularibus divaricatis. *Discus* leviter lobatus. *Stylus* inclusus 6 mm longus, stigmatе bifido. *Nucellae* oblongae 1–8 mm longae 1–2 mm latae minute pubescentes.

NATAL.—Bergville: below the Amphletts, Cathkin Peak Area, *Killick* 1866 (PRE, holo.).

Prostrate, mat-forming, much-branched herb, covered with multicellular hairs (especially dense on stems), gland-dotted; internodes 0·5–1·5 cm long. *Leaves* broadly ovate to round, 0·5–1·1 cm long, 0·4–1·0 cm wide, round at base and apex, margins shallowly crenate; petioles 2–4 mm long. *Flowers* solitary in axils of leaves. *Pedicels* 3 mm long, bibracteate below middle; bracts linear-lanceolate, 1·5 cm long, keeled. *Calyx* campanulate, 15-nerved; tube just under 2 mm long; lobes equal, triangular-lanceolate, 2 mm long. *Corolla* cobalt-violet, glabrous inside except for few hairs at base of lower lip; tube narrowly campanulate, 5 mm long; lower lip 3-lobed, lateral lobes round, 2 mm diam., middle lobe emarginate 2 mm long, 2–5 mm wide; upper lip emarginate, 2 mm long, 3 mm wide. *Stamens* didynamous, somewhat arcuate, lower 3 mm long, upper 2 mm long; anthers 2-celled, cells divaricate. *Disc* slightly lobed. *Style* included, 6 mm long; stigma bifid, the posticous lobe the shorter. *Nutlets* oblong, 1·8 mm long, 1·2 mm wide, minutely pubescent.

This species was found growing at the side of a bridle path in *Festuca costata* Grassveld at 6,800 feet just below the Amphletts in the Cathkin Peak Area of the Natal Drakensberg. Although the author has spent nearly three years in the Drakensberg doing botanical survey work, he has seen *S. compacta* growing in only the one locality.

*S. compacta* is related to *S. reptans* and *S. grandibracteata*, but can be readily distinguished from these species. Vegetatively it differs in being denser and much more compact in habit; it forms mats about 45 cm in diameter. Florally it differs mainly in that the flowers are smaller and the lower lip of the corolla is equal or shorter than the upper lip.





# x *Ruttyruspolia*, a Natural Intergeneric Hybrid in Acanthaceae

by

A. D. J. Meeuse and J. M. J. de Wet

A plant recently collected near Wyllie's Poort, Transvaal (*Meeuse* 9793) exhibited characteristics of both the genera *Ruttya* Harv. and *Ruspolia* Lindau and could not be matched by any herbarium specimens from tropical or South Africa. This, together with the fact that this plant, of which only one single specimen was seen, did not produce seeds, led to the assumption that it could be a hybrid between the only representatives of these genera occurring in the Soutpansberg area, viz., *Ruttya ovata* Harv. and *Ruspolia hypocrateriformis* (Vahl) Milne-Redh. var. *australis* Milne-Redh. As natural intergeneric hybrids are rare and had not before been reported in Acanthaceae, additional evidence was required to support the assumption.

## MATERIAL AND METHODS

Flowers of the supposed *Ruspolia* parent were emasculated when the buds just began to show colour and pollinated two days later with *Ruttya* pollen. Root-tips for a study of the chromosome numbers were fixed in Randolph's (1935) "CRAF" fluid, dehydrated using n-butyl alcohol and embedded in a mixture of paraffin, beeswax and rubber. Sections were cut  $12\ \mu$  thick and stained in Stockwell's (1934) solution. For a study of meiosis, anthers were fixed in 3:1 alcohol and propionic acid, squashed and stained in a propionic acid-carmin solution as described by Swaminathan, Magoon and Mehra (1954).

## RESULTS AND DISCUSSION

From the numerous pollinated flowers a few viable seeds were obtained. Two plants were raised which started flowering six months after planting. These plants are morphologically very similar to the clone *Meeuse* 9793 and differ from it only slightly in the colour of the corolla. This provides a strong indication of the hybrid origin of the plant discovered in Wyllie's Poort.

In the artificial hybrid the corolla has a peculiar mauvish-pink colour which is nearest "Rocellin Purple" (Ridgway, 1912, XXXVIII, 71" V. RR. b); in the wild plant the colour of the corolla is of a deeper hue. In the *Ruspolia* parent the corolla is a clear scarlet red (Bruce 1954) and in *Ruttya ovata* it is white with minute mauve-purple dots in the throat on the side of the lower lip.

The generic characters of the two parent genera involved are practically identical as regards genitalia, pollen morphology, fruit and seeds. The only essential difference between them is in the shape of the corolla which is more or less distinctly bilabiate with a short tube gradually widening into the throat in *Ruttya*, and sub-equally 5-lobed with a long narrow cylindric tube in *Ruspolia*. Cytologically they differ in basic chromosome number, but not in chromosome size. Both genera are characterised by extremely small chromosomes in multiples of  $n = 9$  ( $2n = 36$ ) in *Ruttya*, and  $n = 7$  ( $2n = 42$ ) in *Ruspolia*. During pollen development the chromosomes associate into 18 pairs in *Ruttya ovata* and into 21 pairs in *Ruspolia hypocrateriformis* var. *australis*.

The hybrids under discussion have most of the morphological characters of the *Ruspolia* parent, but a markedly shorter and somewhat wider corolla-tube. The inflorescence is elongated and pseudo-spicate and the corolla-limb subregularly 5-fid as in *Ruspolia*. The colour of the corolla in the hybrids is found in neither parent, but is characteristic of both the natural and the artificial hybrids. The corolla-lobes are marked on the inside (upper surface in open flowers) near the base with fine dots of a deep, somewhat purplish red to deep amaranth red, a character which is also derived from the *Ruspolia* parent.

The natural and artificially produced hybrids are completely sterile. Back-crossing with either of the parents proved unsuccessful. The natural hybrid has not been studied cytologically. The artificial one has 39 small somatic chromosomes. During pollen development pairing is almost completely absent between the two parental sets of chromosomes. In the pollen mother cells 39 univalents are usually present and these chromosomes are distributed at random over the two poles with an appreciable number of laggards which are excluded from the two daughter nuclei. Only very occasionally a maximum number of two bivalents was observed.

In our opinion this hybrid has excellent potentialities as an ornamental. Upon introduction into horticulture a convenient name is desirable, but as the hybrid is a sterile  $F_1$  it is not deemed advisable to give it a scientific name at the specific level. Apart from the formal description of the hybrid genus, only a horticultural name is proposed. It is thought that the artificial hybrid and the natural one do not differ sufficiently to warrant different horticultural names for each of them.

$\times$  *Ruttyruspolia* A. Meeuse et de Wet, gen. hybr. nov. (*Ruttya* Harv.  $\times$  *Ruspolia* Lindau), a *Ruttya* tubo corollae subcylindrato longiore, limbo subregulari 5-fido differt, a *Ruspolia* tubo corollae brevior recedit.

*Ruttyruspolia* 'Phyllis van Heerden' = *Ruttya ovata* Harv. ♂  $\times$  *Ruspolia hypocrateriformis* (Vahl) Milne-Redh. var. *australis* Milne-Redh. ♀.

In order to distinguish this hybrid from other theoretically possible *Ruttya*  $\times$  *Ruspolia* hybrids, this name is intended only to include all  $F_1$ -hybrids (hybrid clones and sub-clones, respectively) which are derived from the parent species indicated above and resemble *Ruspolia hypocrateriformis* var. *australis* in morphological characters, except in the much shorter corolla tube. The colour of the corolla is a shade of "Rocellin Purple" (Ridgway XXXVIII, 71". V. RR. b), or approximately so. The corolla lobes are in addition marked near the base inside with fine dots of a deep red to amaranth red colour.

The horticultural name proposed commemorates the fact that it was Mrs. P. van Heerden of Louis Trichardt, Northern Transvaal, who first discovered the natural hybrid and subsequently introduced it into horticulture.

It is feasible that other intergeneric hybrids in Acanthaceae can be artificially produced, because although the basic chromosome number varies rather widely in this family, the same number (or a near number) is sometimes found in different genera (Grant, 1956, Raghavan, 1957, Takizawa, 1957, Mangenot and Mangenot, 1957). In this way horticultural novelties could be developed. Most Acanthaceae can easily be propagated by means of cuttings and the sterility in intergeneric crosses need, therefore, not be a hindrance. It may even be an asset because the flowers do not become fertilized and, as we have observed in  $\times$  *Ruttyruspolia*, remain fresh for several days instead of wilting soon after having been pollinated (as is the rule in this family). Judging by our example, experimental cross-breeding work in this family for horticultural purposes seems promising and is to be strongly recommended.

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# Notes and New Records of African Plants

by

Various Authors

## ACANTHACEAE

**Barleria** (Sect. *Prionitis*) *ameliae* A. Meeuse, spec. nov., *B. delagoensis* Oberm. arcte affinis, sed bracteolis brevioribus, sepalis eglandulosis, sepalo postico sepalo antico excedens, praecipue differt.

Suffrutex erectus perennis pauca ramosus 30–60 cm altus. *Caules* subquadrangulati plus minusve puberuli vel sparsissime strigosi demum tereti, glabrescentes. *Folia* elliptica vel plus minusve ovato-elliptica vel subobovata firmiter herbacea in siccitate papyracea vel subpergamacea, breviter acuminata obtusa vel subacuta, pungentia, basi attenuata vel longe decurrentia, subglabra, 3–9 cm longa 2–5 cm lata, petiolis apice vel totus alatis ad 3 cm longis, spinis axillaribus paucis vel interdum nullis albescentibus 2–4 mm interdum ad 7 mm longis. *Flores* axillares subsessiles, in parte superiore ramorum in inflorescentiis spiciformes aggregati, bracteolis linear-subulatis pungentibus minutissime aculeato-hirtellis 4–6 mm longis. *Sepala* in apices pungentes attenuata extus sparse intus subdense strigosa, eglandulosa, sepalo antico 11–13 mm longo 5–6 mm lato, sepalo postico 14–17 mm longo 4–5 mm lato, sepalis interioribus angustioribus 11–13 mm longis 1.5–2 mm latis. *Corolla* flava, extus minute molliter pubescens, tubo 12–14 mm longo, labio superiore 18–20 mm longo 4-lobato lobis subaequalibus obovato-ellipticis c. 13 mm longis, labio inferiore integro 10–11 mm longo. *Pistillum* glabrum. *Capsula* 14 mm longa 4 mm lata attenuato-rostrata plus minusve puberula.

SOUTH WEST AFRICA.—Caprivi Zipfel: Eastern area, Mpilila Island, under trees on rock outcrop near Chobe River bank, Killick and Leistner 3391 (PRE, holo.!, K, L, M, SRGH, Windhoek, isos.!).

SOUTHERN RHODESIA.—Wankie: Wankie, Levy 150 (PRE), 1113 (PRE, SRGH); Wankie Game Reserve, vleis edge, Wild 4751 (PRE, SRGH). Nuanetsi: Lundi River, near rapids above big bend, in patches of woodland, Davies 2051 (SRGH).

Suffruticose erect perennial 30–60 cm high. *Stems* usually not much branched, when young green (drying brown) and quadrangular, somewhat puberulous and/or with very few strigose hairs, soon quite glabrous, ultimately terete and covered with a thin greyish-yellow to pale brown bark. *Leaves* elliptic or somewhat ovate or obovate-elliptic, firmly herbaceous drying papyraceous to somewhat pergamaceous, subentire, cuneate-attenuate to long-decurrent at the base, shortly acuminate into a blunt or subacute pungently mucronate apex, glabrous except a sparse strigose pubescence on the basal portions of midrib and main veins (mainly on lower surface) and along the subciliate margin, 3–9 cm long and 2–5 cm broad; cystoliths minute, inconspicuous; petioles winged by the decurrent leaf-base in upper part or throughout, up to 3 cm long, in the axils usually with straight to slightly curved whitish slender 2–4 mm, occasionally up to 7 mm long spines. *Flowers* subsessile in the axils of normal leaves and the uppermost ones in the axils of smaller floral leaves running into a terminal pseudo-spike; bracteoles linear-subulate, pungent, minutely scabrid-hirtellous, 4–6 mm long, pedicels very short, usually somewhat strigose. *Sepals* sparsely strigose outside, more densely so inside, subciliate, eglandular, attenuate into the pungent tips; of the outer oblong

lanceolate concave ones the anticous one is 11–13 mm long, 5–6 mm broad and usually with two adjacent small spines rarely a single spine at the apex, and the posticous one 14–17 mm long and 4–5 mm broad; inner sepals linear-lanceolate, 11–13 mm long and 1.5–2 mm broad. *Corolla* orange-yellow or creamy-yellow, on the outside finely and softly pubescent, more densely so on the 12–14 mm long tube; the upper lip 18–20 mm long, 4-lobed with subequal obovate-elliptic about 13 mm long lobes; the lower lip 10–11 mm long. *Pistil* glabrous. *Capsule* 14 mm long and 4 mm broad, greyish-brown, attenuate-beaked at the apex, somewhat puberulous.

This species is in habit exceedingly like *B. delagoensis* Oberm., a coastal species from Portuguese East Africa, but it differs constantly in the non-glandular sepals (with stipitate glands in *B. delagoensis*), of which the posticous one is the longest (it is the shortest in *B. delagoensis*), in the shorter bracteoles, in the usually shorter axillary spines; in the somewhat puberulous capsules (pilose in *B. delagoensis*) and in several other points. The leaves are more decurrent on the petiole and are relatively somewhat broader in *B. ameliae*, the cystoliths are inconspicuous (distinct in *B. delagoensis*), the sepals are shorter than in *B. delagoensis* (the three shorter ones up to 13 mm long, as against the longest three 17 mm long in *B. delagoensis*) and the relative lengths of the parts of the corolla are not the same: tube 12–14 mm long against 12 mm in *B. delagoensis*, the upper lip 18 mm long as against 21 mm; its lobes 13 mm against 15 mm and the lower lip 10–11 mm against 16 mm, i.e. a relatively longer tube and relatively (and absolutely) shorter limb in *B. ameliae* as compared with *B. delagoensis*. There are also differences in the degree and type of pubescence of stems, leaves and sepals. All these differences together indicate that in spite of the close resemblance the two forms are not of varietal status but represent two distinct species. This view is supported by the difference in ecology, *B. delagoensis* being a coastal plant found on alluvial soils near the sea-shore in an area with very mild winters, a high rainfall and a high humidity of the air almost throughout the year, whereas *B. ameliae* is a plant of the interior growing at altitudes between 1,000 and 3,000 ft. in areas with a lower annual rainfall and a pronounced dry winter season with low humidity and often low temperatures.

This species is named after Mrs. A. A. Mauve (née Obermeyer) who contributed so much to the knowledge of the genus *Barleria* in Southern Africa and kindly studied the cited material to confirm my views that the plant under discussion represents a hitherto undescribed taxon.

A. MEEUSE

***Barleria argillicola* Oberm. sp. nov., *B. bolusii* Oberm. affinis, sed floribus solitariis planta subglabra bracteis absentibus corolla 3.5 cm longa differt.**

*Fruticulus* parvus. *Rami* e rhizomate orti. *Folia* coriacea glabra nitida margine alba undulata integra vel parce spinosa. *Flores* solitarii. *Bractee* absentes. *Corolla* 3.5 cm longa. *Stigma* capitata.

Small plants up to 20 cm high, deep rooted. *Stem* perennial, woody, rhizomatous giving off short annual shoots which are unbranched or form 1–2 short basal branches, minutely pubescent in the grooves, nodes bristly. *Leaves* lanceolate, ca  $3 \times 1$  cm, coriaceous, glabrous, shiny, apex tipped with a short spine, tapered at the base into a short petiole, or sessile, margin white, wavy, entire or sparsely spinous. *Flowers* solitary, axillary, bractless. *Bracteoles* about as long as the leaves but narrower and with a prominent lateral nerve on each side of the midrib. *Calyx* with the posticous sepal broadly ovate, reticulate, spine tipped, about as long as the bracteoles; anticous similar to posticous but bispinous at the apex; lateral segments small, linear, 1 cm long. *Corolla* pale mauve, with a narrow tube 2 cm long, limb 5-lobed, regular, somewhat shorter than the tube. *Stamens* dissimilar, two protruding from tube, two smaller included, the fifth represented by a short filament only. *Ovary* glabrous, style filiform, stigma capitate. *Capsule* typical, 2 cm long.

NATAL.—Estcourt: Rensburg Spruit near Estcourt, eroded thornveld slopes, frequent in patches, in flower October 1944, *Acocks* 10701 (PRE, holo. NH iso); near Estcourt in Bushman's River Valley, eroded clay banks of Rensburg Spruit, with fruit, December 1943, *Acocks* 9968 (PRE, NH); *Edwards* 2458 (PRE).

The species comes under the section *Eubarleria*, *Pungentes*. The stigmas are confluent, capitate. Its nearest ally seems to be *B. bolusii* Oberm. (*B. mosdenensis* Oberm. is a synonym of *B. bolusii* Oberm.) but it is very different from this species. The flowers are solitary, the plant is glabrous except for a slight short pubescence on the stem and the corolla is 3.5 cm long. The narrow white leaf margin is a conspicuous character. Mr. D. Edwards who visited Acocks' locality in November 1959, found it there exclusively on the eroded, clayey neutral to alkaline soils. Excellent photographs and colour slides of the flowering plants were made by him.

***Barleria saxatilis* Oberm. sp. nov., *B. eleganti* S. Moore affinis, sed floribus minoribus dilute purpureis cymis parvifloris differt.**

Suffruticosa. *Rami* strigosi et pilis brevibus patentibus dense pubescentes. *Folia* oblonga herbacea lamina inferiore pallide viridia. *Inflorescentiae cymae* unilaterales 1–4 florum; bracteoli lineares spinoso-dentati; sepalum posticum ovatum, spinosodentatum papyraceum reticulatum; sepalum anticum postico simile sed paulo minorius; corolla dilute purpurea, tubo angusto faucem versus gradatim paulo expanso 15 mm longo, limbo 5-lobato sub-regulari; stamina perfecta 2, exserta; stamina imperfecta brevia inclusa. *Capsula* glabra 1 cm longa 4 mm lata apiculata.

A straggling or erect shrub 30–150 cm tall. *Branches* woody white puberulous and strigose. *Innovations* densely strigose. *Leaves* variable in size, oblong to lanceolate, up to 3 cm long and up to 2 cm wide, usually smaller, apex obtuse, in 1–4 flowered sessile cymes. *Bracteoles* unequal, firm, spinoso-dentate, the lower smaller, linear, recurved from the base; the upper erect, lanceolate-acuminate. *Outer sepals* ovate, acuminate, up to 2 cm long including spine, 9 mm wide, with ca 16 marginal spines 1–3 mm long, reticulate, sparsely strigose, green at first, stramineous in fruit but apparently not enlarged. *Inner sepals* linear, 1 cm long. *Corolla* puberulous, bluish mauve; tube narrow, 15 mm long, slightly widened at the apex; limb 5-lobed ca 11 mm long. *Stamens* inserted in lower half of tube, the fertile ones well exserted, filaments linear; 3 sterile short, included, one represented by a minute filament only. *Ovary* glabrous, style filiform 2 cm long, with a ring of short hairs at the base; stigma short, filiform. *Capsule* glabrous, just exserted from the outer sepals, 1 cm long, 4 mm broad, apiculate.

*Flowering. Period:* March onwards.

*Distribution:* In the drier parts of the northern and eastern Transvaal, usually on rocky hillsides.

TRANSVAAL.—Soutpansberg: Sandrivier Poort, southern end, on a stretch 1–8 miles from main road bridge, *Meeuse* 10203 (PRE, holo.) Farm Soutpan, lower northern slopes of the Soutpansberge, *Obermeyer*, *Schweickerdt* and *Verdoorn* 130. About two miles south of Wyliespoort, *Meeuse* 9790. Pietersburg: *Rogers* 14151; Mokeetsi, *Obermeyer* TM 31977; two miles S.E. of Chuniespoort Hotel, *Obermeyer* and *Verdoorn* 13; Blaauwberg near Leipzig Mission Station, *Codd* 8713. Waterberg: Nylstroom Mountains north of Warmbad, *Obermeyer* TM 31978. Pilgrims Rest: Kruger National Park, Gorge, *van der Schijff* KNP 2294. Lydenburg: Rustplaats, *Taylor* 1943.

The species is closely related to *B. elegans* S. Moore but can be distinguished by its few flowered, mauve cymes, usually more dense pubescence and its thinner less rigid branches. The capsule of *B. elegans* usually reaches a length of 15 mm whilst that of *B. saxatilis* is only about 10 mm long. The calyx and bracteoles are also correspondingly smaller in *B. saxatilis*. It inhabits dry hot areas of the Transvaal



bushveld, where it has established itself very firmly, being dominant for miles in some parts. *B. elegans* occurs along the coast but is also found in more humid places in the Low Veld near rivers.

At Leipzig Mission Station Dr. Codd noticed that bunches of dried stems were tied round poles of grain stores to repel rats.

A. AMELIA OBERMEYER

***Sclerochiton triacanthus*** A. Meeuse, spec. nov., *S. scissisepalo* C. B. Clarke affinis, sed inter alia ramulis pilosis, foliis minoribus angustioribus, bracteis fertilibus apice breviter trispinosus differt.

Frutex suberectus e basi ramosus 0.50–1.00 m altus. *Caules* subteretes lignosi breviter albo-pilosi, demum glabri, cinnamomei vel cinerascetes. *Folia* ad apicem ramulorum plus minusve aggregata, subcoriacea, subsessilia, nitida, oblongi-lanceolata vel lanceolato-linearia, integra, convexa vel subplana margine deflexa vel revoluta, basin versus interdum ciliata, apice pungentia, subglabra, 2–5 cm longa, 4–9 mm, interdum ad 15 mm, lata, costa media subtus prominenti interdum subtus basin versus sparse pilosa, cystolithis inconspicuis. *Inflorescentiae* terminales vel laterales, subsessiles pauciflorae densae, ad 6 cm longae, bracteis bracteolisque firmiter herbaceis plus minusve concavis carinatis vel subcarinatis puberulis vel subglabris plus minusve ciliatis. *Bracteae* oblongae vel lineari-oblongae, inferiorae steriles parvae innocuae vel pungentes, fertiles majores 14 mm longae 4 mm latae spinulis 3 apicalibus pungentes. *Pedicelli* satis robusti, 3–5 mm longi, bibracteolati, bracteolis lineari-lanceolatis sparse puberulis 16–18 mm longis 3–4 mm latis spinulis 1–3 pungentibus. *Sepala* 5, acuta, pungentia, subglabra, plus minusve ciliata; sepalum posticum late lineare acutum infra medium ciliatum, apice unispinulosum vel interdum 2–3-spinulosum, 23–24 mm longum, 4–5 mm latum, sepala 2 antica lineari-lanceolata, 16–18 mm longa, 3 mm lata, sepala lateralia lineari-lanceolata, 15–17 mm longa, 2–2.5 mm lata. *Corolla* dilute azurea, coerulesco-venosa, tubo ca 7 mm longo, limbo ca 19 mm longo extus parce sericeo intus lineis 2 pilorum subpatentorum cincto, lobis subaequalibus obovato-oblongis apice rotundatis 4–5 mm longis. *Stamina* basin versus retrorse sericea, filamentis ca 11 mm longis, antheris hirsuto-pubescentibus ca 2 mm longis. *Ovarium* puberulo-velutinum, apice pilis erectis comosum, 3–4 mm longum, stylo basin versus pilis setaceis patentibus albedo-fulvidis barbato 14–15 mm longo. *Capsula* anguste oblonga, glabra, ca 14 mm longa.

TRANSVAAL.—Barborton: Barborton, Rogers 24047 (PRE); about five miles from Barborton on road to Florence Mine, Mr. and Mrs. P. F. Clarke 12 (PRE, holo.!).

A somewhat straggly to erect low shrub, usually 40–60 cm tall but occasionally attaining about 1 m, branched from the base upwards, usually slender in habit, but in some cases forming a “bush” or thicket 1–2.5 m across. *Stems* subterete, woody, dark brown and shortly pilose with whitish patent hairs, usually rather densely so, later glabrescent and turning cinnamon-coloured or ashy-grey, forming a thin, nearly smooth or somewhat (longitudinally) wrinkled bark. *Leaves* more or less distinctly aggregated at the tips of the branches or on short side-shoots, subcoriaceous, subsessile, shiny, oblong-lanceolate to linear-lanceolate, entire, usually somewhat convex through the deflexed margins, glabrous or ciliate near the base, sometimes sparsely pilose on the midrib, narrowing at the base into the very short pilose petiole, subobtuse to acute at the spine-tipped apex, distinctly veined, 2–5 cm long and 4–9 mm (on young shoots occasionally up to 15 mm) broad; midrib prominent on lower surface; cystoliths indistinct or invisible. *Inflorescences* terminating the branches and short side-shoots, dense, few-flowered, up to about 6 cm long. *Bracts* oblong to linear-oblong, firm, green; lower sterile ones short, innocuous or pungent, fertile ones larger, about 14 mm long and 4 mm broad, more or less concave to boat-shaped and somewhat carinate, as are the bracteoles, puberulous or glabrous usually ciliate along the margins, especially about the middle, at the apex with three small spines. *Pedicels* rather stout, 3–5 mm



long, bibracteolate in the middle; bracteoles linear-lanceolate, with 1-3 small apical spines, sparsely puberulous, often somewhat ciliate, 16-18 mm long and 3-4 mm broad. *Sepals* 5, acute, pungent, subglabrous often somewhat ciliate; posticous sepal broadly linear, acute with 1-3 apical spines, 23-24 mm long and 4-5 mm broad; 2 anticus sepals linear-lanceolate, 16-18 mm long and 3 mm broad; 2 lateral sepals linear-lanceolate, 15-17 mm long and 2-2.5 mm broad. *Corolla* a light but bright blue with darker blue reticulate veins; tube about 7 mm long, glabrous; limb about 19 mm long, on the outside (lower side) silky pubescent, on the inside with two broad lines of hairs, its lobes subequal obovate-oblong rounded at the apex, 4-5 mm long. *Stamens* towards the base retrorsely silky pubescent; filaments about 11 mm long, anthers shortly hirsute-pubescent, 3-4 mm long. *Ovary* densely puberulous to velutinous and with a dense apical tuft of erect stiff, almost bristly hairs, 3-4 mm long; style 14-15 mm long towards the base with setaceous hairs which form an abaxial line becoming denser and broader towards the base, these hairs and those on the ovary yellowish and fawnish. *Capsule* narrowly oblong, glabrous, about 14 mm long.

This species was discovered by F. A. Rogers as early as 1921, but it was apparently not collected again till Mr. and Mrs. P. F. Clarke found it in the summer 1955/56. It is probably one of those local endemics in which the Barberton area is so rich. I am indebted to the collectors for the following extensive notes:

"The plant is a straggly, low-growing shrub, averaging about 2 ft. in height and possibly attaining a maximum of 3 ft. It is branched, usually slender, but in some cases forming a bush or thicket 3 or 4 ft. across. It is fairly common in the locality in which it was found, but we have not yet observed it elsewhere. It grows in shallow shaly soil, sloping steeply, on shale outcrops—a very well drained position, facing S.W. It occurs in fairly open bush consisting mainly of *Kirkia*, *Bauhinia galpinii*, *Peltophorum*, *Bowkeria*, *Acacia ataxacantha*, *Heteropyxis*, *Ziziphus*, *Acacia karroo*, *Dalbergia*, and in association with *Royena*, grasses, aloes, *Orthosiphon*, *Crossandra* and many other unidentified plants. The *Sclerochiton* is found in partial shade—where the bush is thick it does not occur. The flowers are clear blue in colour (see accompanying sketch). Unripe fruit are plentiful and a few ripe fruits were found."

Characteristic of the species are the narrow linear-oblong leaves with deflexed margins and the 3-spined fertile bracts, two characters which I have not found in any other species I have studied. The seeds in the capsules had all been eaten by insects and could not be described.

A. MEEUSE

## APOCYNACEAE

### ACOKANTHERA

When G. Don described the genus in his *Gen. Syst.* 4: 485 (1838), he explained that the name is derived from the Greek "acoce", a mucrone, referring to the mucronate anthers characteristic of *Acokanthera* spp. In writing the Greek word he translated the Greek *kappa* in both cases as a roman c, but he spelt the generic name *Acokanthera*. Subsequent authors have considered that, to be consistent, the genus should be spelt either *Acokanthera*, as was done by Endlicher, *Gen. Pl. Suppl.* 1: 1404 (1841), Pfeifer, *Nom. Bot.* 1: 29 (1873) and K. Schumann in *Pflanzenfam.* 4, 2: 126 (1895), or *Akokanthera*, as proposed by Walpers, *Rep.* 3: 122 (1845). Stapf retained the spelling *Acokanthera* in *Fl. Trop. Afr.* 4, 1: 92 (1902) and in *Fl. Cap.* 4, 1: 499 (1907) but, in *Kew Bull.* 29 (1922), he stated a preference for *Acocanthera* "in the place of the absurd and barbarous form *Acokanthera*, found in G. Don's *Generum Systema*, which is evidently due to a printer's error". There seems, however, equal reason for concluding that Don deliberately spelt the name *Acokanthera* and, unless there is clearer evidence to the contrary, this spelling should be retained.

*Acokanthera* is closely related to *Carissa*, under which genus it is placed in synonymy by Pichon in Mem. Mus. Nat. Hist. Paris, n.ser. 24: 132 (1948) and Bull. Jard. Bot. Brux. 22: 109 (1952). It is considered, however, that there are adequate reasons for maintaining it as distinct. In support of this view may be cited the essentially practical reason that species of *Acokanthera* have a characteristic facies, which permits the assignment of even sterile specimens without difficulty, even though the characteristics are not easy to define in words. Florally, the two genera are closely allied but, in *Acokanthera*, the inflorescence is axillary, not terminal or pseudo-axillary as in *Carissa*, and the stamens are situated at the apex of the corolla tube, with the tips of the anthers often exerted. In *Carissa*, the stamens are situated from about the middle of the tube to near the apex, with the mouth of the tube slightly constricted, so that the tips of the anthers are not visible. There are also small differences in the shape of anthers and stigma.

The genus *Carissa* (in the sense of Stapf in Flora Capensis and Flora of Tropical Africa) may be divided into two sections: Section *Carissa*, in which the corolla lobes overlap to the right; and Section *Arduina*, in which the corolla lobes overlap to the left (as in *Acokanthera*). Section *Carissa* includes armed and unarmed species, occurring in Africa, Madagascar, Asia and Australia. In Section *Arduina*, all species are armed (though occasional herbarium specimens may lack spines) and the species are limited to eastern and southern Africa. Thus, although the presence or absence of spines would not alone constitute a generic difference, the character may be used in conjunction with the direction of overlap of the corolla lobes to separate *Acokanthera* and *Carissa*. A further practical reason for keeping the two genera separate is that *Acokanthera* species all have a highly toxic substance in the sap, while this does not appear to be the case in species of *Carissa*.

#### *Typification of the genus Acokanthera*

As indicated by Phillips, Gen. S. Afr. Flow. Pl. ed. 2: 583 (1951), the type of the genus *Acokanthera* has been regarded as *A. venenata* G. Don, generally written *A. venenata* (Thunb.) G. Don. It is clear from what follows that this view can no longer be held without altering the circumscription of the genus. In order to retain the genus *Acokanthera* in its present sense, therefore, it is proposed that the type of the genus should be accepted as *A. lamarckii* G. Don, a superfluous name for *Cestrum oppositifolium* Lam., which is now combined in *Acokanthera*.

***Acokanthera oppositifolia* (Lam.) L. E. Codd, comb. nov.**—*Cestrum oppositifolium* Lam. in Tab. Encycl. Bot. 2: 5, t. 112, fig. 2 (1797). Type: Africa, *Sonnerat* (P). *C. venenatum* Burm. f., Fl. Cap. Prodr. 5 (1768), non *Acokanthera venenata* G. Don (1838). Type: South Africa, *Banks* (G). *C. venenatum* Thunb., Prodr. 1: 36 (1794); Fl. Cap. ed. Schult. 193 (1823), non *C. venenatum* Burm. f. (1768). Type: South Africa, *Thunberg* (U).

*Sideroxylon toxiferum* Thunb., Trav. ed. 3, 1: 156 (1795), nom. nud.

*Acokanthera lamarckii* G. Don, Gen. Syst. 4:485 (1838), nom. illegit. Type: as for *Cestrum oppositifolium* Lam. *A. venatorium* E. Mey. in Drege, Zwei Pfl. Doc 171 (1843); Sond. in Linnaea 23: 79 (1850); nom. nud. *A. venenata* sensu Stapf in F.T.A. 4, 1: 94 (1902); F.C. 4, 1: 500 (1907); Sim, For. Fl. Cape Col. 270, t.154, fig. 1 (1907); Marloth, Fl. S. Afr. 3, 1: t.17 (1932); Brenan & Greenw., Check-list Tang. Terr. 2: 47 (1949). *A. venenata* (Burm. f.) G. Don ex C. A. Smith in J. S. Afr. For. Ass. 20: 42 (1951), nom. illegit. var. *scabra* (Sond.) Markgf. in Notizbl. Bot. Gart. Berl. 8: 470 (1949).

*Toxicophlaea thunbergii* Harv. in Hook. Lond. Journ. Bot. 1: 24 (1842); Thes. Cap. 10, t. 16 (1859); Sond. in Linnaea, 23: 78 (1850). Type: as for *Cestrum venenatum* Thunb. *T. thunbergii* var. *scabra* Sond., l.c. Type: based on several syntypes. *T. cestroides* A.DC. in DC., Prodr. 8: 336 (1844). Type: as for *Cestrum venenatum* Thunb.

*Carissa acokanthera* Pichon in Mem. Mus. Hist. Nat. Paris, n.s. 24: 132 (1948). *C. oppositifolium* (Lam.) Pichon in Bull. Jard. Bot. Brux. 22: 109 (1952).

In the protologue to *Acokanthera venenata*, G. Don cites *Cestrum venenatum* Thunb. and *C. citrifolium* Retz. It may be assumed that his intention was to take up Thunberg's epithet in his genus *Acokanthera*. As pointed out by Mr. Dandy on p. 428 of this journal, however, *C. venenatum* Thunb. (1794) must be regarded as an illegitimate homonym of *C. venenatum* Burm. f. (1768) and therefore has no standing. The epithet *venenatum* Burm. f. cannot be taken up in *Acokanthera*, thus the next legitimate name which is available, namely, *C. oppositifolium* Lam. must be adopted.

Nomenclaturally, because *C. venenatum* Thunb. is illegitimate, the name *Acokanthera venenata* G. Don becomes a synonym of *C. citrifolium* Retz. (for which it is a superfluous epithet), not of *C. venenatum* Thunb. *C. citrifolium* Retz. (1803) is based on a plant cultivated at Lund. The opportunity to study the type specimen was made possible by the kindness of the Keeper of the Lund Herbarium, Dr. Norlindh, who sent the holotype on loan to Pretoria. An examination of this specimen shows that it is not conspecific with *Cestrum venenatum* Thunb., as indicated by G. Don. It probably belongs to *Cestrum* or a closely allied genus and it is unlikely that it came originally from South Africa.

***Acokanthera oblongifolia* (Hochst.) L. E. Codd, comb. nov.**—*Carissa oblongifolia* Hochst. in Flora, 827 (1844). Type: Natal, Krauss (K). *C. spectabilis* (Sond.) Pichon in Mem. Mus. Hist. Nat. Paris, n.s. 24: 132 (1948). *Toxicophlaea spectabilis* Sond. in Linnaea, 23: 79 (1850). Syntypes: Port Natal, Gueinzus 37; 511. *Acokanthera spectabilis* (Sond.) Hook. f. in Bot. Mag. t. 6359 (1878); Stapf in Fl. Cap. 4, 1: 501 (1907). *A. venenata* var. *spectabilis* (Sond.) Sim, For. Fl. Cape Col. 270, t. 154, fig. 2 (1907).

Mr. W. Marais examined type material of *Carissa oblongifolia* Hochst. (1844) at Kew and reports it to be conspecific with *Toxicophlaea spectabilis* Sond. (1850). The former epithet must, therefore, be taken up. *A. oblongifolia* is closely allied to *A. oppositifolia*, but can usually be distinguished by the longer corolla tube, the large, plum-like fruits and the indistinct secondary nerves on the underside of the leaves.

***Acokanthera schimperii* (A.DC.) Schweinf. var. *rotundata* L. E. Codd, var. nov.**, sed a typo foliis majoribus rotundioribus plerumque scabridis differt.

Frutex vel arbor parvus ad 3 m altus, ramulis tomentosis vel puberulis. *Folia* coriacea scabrida late elliptica usque subrotunda 4–7 cm longa 3·5–5·5 cm lata, apice obtusa usque rotunda mucronata, basi obtusa usque rotunda, nerviis secundariis obscuris, petiolo robusto 2–6 mm longo. *Inflorescentia* multiflora subsessilis corymbosa, bracteis ovatis 1·5 mm longis caducis, floribus sessilibus. *Calyx* 2–2·5 mm longus puberulus usque tomentulosus, sepalis ovato-lanceolatis acuminatis. *Corolla* hypocrateriformis, tubo subcylindrato 8–9 mm longo pubescenti vel glabro, lobis 5 ovatis obtusis 4·4–5 mm longis 2 mm latis. *Stamina* 5 in faucibus corollae inserta leviter exserta, antheris ovatis pubescentibus breviter mucronatis. *Ovarium* integre 2-loculare, loculis 1-ovulatis, stylo filiforme 7–8 mm longo, stigmathe parvo conico apice bifido. *Fructus* baccatus globosus vel subglobosus 1·5–2 cm diam. *Semina* 1–2 late elliptica, endospermo carnoso.

TRANSVAAL.—Sibasa: Kruger National Park, 3½ miles N. of Kloppefontein, alt. 1,400 ft., flowering and fruiting March 1949, Codd 5432 (type, PRE). Pietersburg: Chuniespoort, Pole Evans H 19451. Nelspruit: Kruger National Park, Klokwe, van der Schijff 758.

S. RHODESIA.—Mangwe, Plowes 1308. Matoppo Hills, near Bulawayo, Galpin 7076; Eyles 6303; Miller 5162.



Shrub or small tree up to 3 m high; branchlets tomentose or puberulous. Leaves coriaceous, scabrid, broadly elliptic to subrotund, 4–7 cm long and 3·5–5·5 cm broad, apex obtuse to rounded, mucronate, base obtuse to rounded; secondary nerves obscure; petiole stout, 2–6 mm long. *Inflorescence* many-flowered subsessile, corymbose; bracts ovate, 1·5 mm long, caducous; flowers sessile. *Calyx* 2–2·5 mm long, puberulous to tomentulose; sepals ovate-lanceolate, acuminate. *Corolla* hypocrateriform, tube subcylindric 8–9 mm long; pubescent or glabrous; lobes 5, ovate, obtuse, 4·4–5 mm long and 2 mm broad. *Stamens* 5, situated in the corolla throat, slightly exerted; anthers ovate, pubescent, shortly mucronate. *Ovary* entire with 2 locules, 1 ovule in each locule; style filiform 7–8 mm long; stigma small conical, apex bifid. *Fruit* baccate, globose or subglobose, 1·5–2 cm in diameter. *Seeds* 1 or 2, broadly elliptic; endosperm fleshy.

The species of *Acokanthera* fall into three main groups, namely: (a) *A. schimperi*, *A. deflersii*, *A. ouabaio* and *A. friesiorum*; (b) *A. oppositifolia*, *A. longiflora* and *A. rhodesica*; and (c) *A. oblongifolia*.

The plant now described, with its subrotund leaves, indistinct secondary venation and more or less globose fruits clearly belongs to group (a). The material that has been seen of this group leads to the impression that there may be only one variable species involved. The oldest name is *A. schimperi* (A.DC.) Schweinf. and the other three may well be reduced to synonymy, or to varieties, as Stapf has already done with *A. deflersii*.

In its usually scabrid leaves, var. *rotundata* resembles *A. deflersii* from Arabia, while in leaf shape it is closer to *A. friesiorum*, though it differs in having larger and less glossy leaves. In distribution it is completely separated from the *A. schimperi* complex, which is recorded from Kenya to southern Arabia, but its characteristics are not sufficiently clear-cut to warrant separating it as a distinct species.

#### CARISSA

*Carissa bispinosa* (L.) Desf. ex Brenan in Mem. N.Y. Bot. Gard. 8: 502 (1954), aggregate species.

The *C. bispinosa* complex is distributed from the south-western Cape Province to Natal, Swaziland, Transvaal and Mocambique, extending northwards to Nyasaland and westwards to Bechuanaland and South West Africa. There is considerable variation in leaf size, shape and texture, size of spines, and situation of the anthers in the corolla tube.

Two main evolutionary trends are recognised and two varieties are upheld. The two varieties overlap geographically, especially in the southern and eastern Cape Province; here several intermediate specimens are found and it is for this reason that the two groups were regarded as not having the status of separate species.

##### (a) var. *bispinosa*.

*Arduina bispinosa* L., Mant. 1: 52 (1767). Type: the plate in Mill. Ic. 2: t. 300 (1760). *Lycium cordatum* Mill., Gard. Dict. ed. 8: No. 10 (1768). *Carissa bispinosa* (L.) Desf. ex Brenan, l.c., excl. specimen cited. *C. bispinosa* Desf., Tabl. Ecol. Bot. 78 (1804), nom. nud.; Desf. ex Steud., Nom. ed. 2: 298 (1841), in synonymy; Merxm. in Mitt. Bot. Munchen, 17–18: 399 (1957). *C. arduina* Lam., Dict. 1: 555 (1785); Stapf in Fl. Cap. 4, 1: 498 (1907), partly, excl. syn. *C. erythrocarpa*, *C. acuminata*, *C. haematocarpa*, *C. ferox*, and *C. oblongifolia*. *C. myrtoides* Desf., Cat. Hort. Paris, ed. 3: 398 (1829). *C. cordata* (Mill.) Fourc. in Trans. Roy. Soc. S. Afr. 21: 82 (1934). *C. cordata* Dinter in Fedde Rep. Beih. 53: 112 (1928), nom. nud. *C. dinteri* Markgf. in Notizbl. Bot. Gart. Berlin, 15: 750 (1942). *Jasminonerium bispinosum* (L.) O. Ktze., Rev. Gen. Pl. 2: 415 (1891).



A much-branched, twiggy shrub up to 3 m high. Leaves thickly coriaceous, 1-3 (rarely to 5) cm long, broadly ovate to ovate-elliptic. Spines robust, up to 5 cm long, bifurcate, twice bifurcate or simple. Anthers situated near the apex of the corolla tube. Style 3-4 mm long.

This variety is found in karroid scrub, bushveld and coastal scrub vegetation, usually in relatively hot, dry situations, in the southern and south-eastern Cape Province, central and western Transvaal and northern South West Africa.

In some specimens from the eastern Cape Province, the robust spines are twice bifurcate, while from the central and western Transvaal and South West Africa specimens are found with simple spines. *C. dinteri* Markgraf is based mainly on the presence of simple spines; in all other respects it is scarcely distinguishable from var. *bispinosa* and is therefore not worth upholding, even as a variety.

The significance of the position of the anthers and length of the style is discussed later under var. *acuminata*.

(b) var. *acuminata* (E. Mey.) L. E. Codd, stat. nov.

*Arduina acuminata* E. Mey., Comm. Pl. 191 (1837): K. Schum. in Pflanzenfam. 4, 2: 126 (1895). Type: between Umzimvubu and Umsikaba Rivers, near large Waterfall, Drege. *A. erythrocarpa* Eckl. in S.A. Quart. J. 4: 372 (1830). *Carissa acuminata* (E. Mey.) A.DC. in DC. Prodr. 8: 335 (1844). *C. erythrocarpa* (Eckl.) A.DC., l.c. *C. arduina* (non Lam.), Stapf in Fl. Cap. 4, 1: 498 (1907), partly, as to syn. *C. acuminata* and *C. erythrocarpa*. *C. megaphylla* Gdgr. in Bull. Soc. Bot. France, 65: 59 (1918). *C. bispinosa* [non (L.) Desf. ex Brenan], Brenan in Mem. N.Y. Bot. Gard. 8: 502 (1954), as to specimen cited.

Shrub up to 5 m high, often sparingly branched and sometimes semi-scandent. Leaves thinly coriaceous to coriaceous, ovate to ovate-lanceolate, 2.5-7 cm long. Spines slender, bifurcate, 0.5-2.5 (rarely to 3.5) cm long. Anthers situated near the middle or towards the apex of the corolla tube. Style 1.5-3 (rarely to 3.5) mm long.

This variety is found in fairly dense woodland such as forest margins and scrub forest in the southern and south-eastern Cape Province, Natal, Swaziland, eastern and northern Transvaal, eastern Southern Rhodesia and Nyasaland.

The anthers are situated near the middle of the corolla tube or towards the apex and, as the stigma accompanies the anthers, the style is shorter in this variety than in var. *bispinosa*. The distinction is more marked from the Transvaal northwards, rather than in the Cape Province and Natal, as is shown in Table I and II which summarise the distribution of style length on a geographical basis in 69 specimens examined.

TABLE I

Style length in 28 specimens of *C. bispinosa* var. *bispinosa*.

Province.	Style length in mm.							Total.
	1.5	2	2.5	3	3.5	4	4.5	
Cape.....	—	—	—	5	2	1	—	8
S.W. Africa.....	—	—	—	—	—	1	—	1
Transvaal.....	—	—	1	2	8	6	1	18
Mocambique.....	—	—	—	—	1	—	—	1
	—	—	1	7	11	8	1	28

TABLE II

Style length in 41 specimens of *C. bispinosa* var. *acuminata*.

Province.	Style length in mm.							Total.
	1·5	2	2·5	3	3·5	4	4·5	
Cape.....	—	2	7	5	1	—	—	15
O.F.S.....	—	—	—	1	—	—	—	1
Natal.....	—	2	4	4	—	—	—	10
Swaziland.....	—	—	1	—	—	—	—	1
Transvaal.....	7	4	—	1	—	—	—	12
S. Rhodesia.....	1	—	—	—	—	—	—	1
Nyasaland.....	1	—	—	—	—	—	—	1
	9	8	12	11	1	—	—	41

An unusual form occurs at high altitudes in the central Transvaal and is represented by the following specimens: Lydenburg District, summit of Lulu Mountains, 4,500 ft., *Mogg* 16963; *Barnard* and *Mogg* 995; Pietersburg District, Wolkberg, 6,000 ft., *Gerstner* 5657. In these specimens the branches are extremely twiggy with very numerous, relatively short, stout, bifurcate spines; the leaves are small, broadly ovate, almost cordate-based, 1–1·5 cm long; and the flowers are smaller than usual with styles 1·5–2 mm long. These specimens have been omitted from the above Tables. They may represent a distinct variety but, until more information is forthcoming, they are best regarded as a form of *C. bispinosa* var. *bispinosa*.

## ADENIUM

*Adenium obesum* (Forsk.) R. and S. var. *multiflorum* (Klotzsch) L. E. Codd, stat. nov.—*A. multiflorum* Klotzsch in Peters, Reise Mossamb. Bot. 279, t. 44 (1861). Type: Tette, *Peters* s.n.

I am indebted to Mr. W. Marais, our liaison officer at Kew, and Mr. Meikle, of the Kew staff, for examining the tropical African material of *Adenium* for me. They came to the conclusion that an excessive number of species names have been published and that the following must be regarded as one species complex: *A. obesum* (Forsk.) R. and S., Syst. Veg. 4: 411 (1819), based on *Nerium obesum* Forsk., Fl. Aegypt.-Arab. 205 (1775); *A. honghel* A.DC. in DC., Prodr. 8: 412 (1844); *A. multiflorum* Klotzsch, l.c.; *A. speciosum* Fenzl in Sitzungsber. Kais. Akad. Wiss. Wien, 51: 140 (1865); *A. arabicum* Balf. f. in Trans. Roy. Soc. Edinb. 31: 161 (1888); *A. micranthum* Stapf in Kew Bull. 334 (1894); and *A. coetanum* Stapf in Fl. Trop. Afr. 4, 1: 227 (1902). Of these, it is considered that only *A. multiflorum* is sufficiently distinct to be worth separating as a variety. It is fairly constant in having acute to acuminate corolla lobes with crisped margins, while the margins are a darker pink, almost scarlet in colour. The southern material has thicker leaves with more or less immersed veins, as against the thinner, markedly veined leaves of material from east and west tropical Africa.

TYPIFICATION OF *PACHYPODIUM SUCCULENTUM* AND *P. BISPINOSUM*

When Linn. fil. described *Echites succulenta* and *E. bispinosa* in his Suppl. 167 (1781), he mixed the characters of the two species. For instance, he describes *E. succulenta* as: “foliis linearibus subtus tomentosis, corollis infundibuliformibus” and *E. bispinosa* as: “foliis lanceolatis glabris, corollis hypocrateriformibus”. Actually, the species with leaves tomentose below has the hypocrateriform corolla and *vice versa*.

Both species were based on *Thunberg* specimens "ad Cap. bonae Spei", and were transferred to the genus *Pachypodium* by A. de Candolle in DC. Prodr. 8: 424 (1844).

Thunberg in his Prodrum, 37 (1794) and Fl. Cap. ed. Schult. 232 (1823) repeats the protologue verbatim but, in the latter work, he adds a more detailed description of the corolla of *E. bispinosa* which agrees with an infundibuliform, not a hypocrateriform, corolla.

E. Meyer, Comm. Pl. 188 (1837) created the genus *Belonites* to accommodate the above two species. He evidently realised the original discrepancy and placed the characters correctly, typifying the species as follows:

1. *Belonites succulenta*: "foliis subtus tomentosis, corollis hypocrateriformibus, limbi laciniis spathulatis. *Echites succulenta* Thunb."

2. *B. bispinosa*: "foliis subtus glabris, corollis infundibuliformibus, limbi laciniis basi latissimis. *Echites bispinosa* Thunb."

This emendation by E. Meyer was followed by Stapf in Flora Capensis 4, 1:517 (1907) and subsequent workers. It is, however, necessary to assess the available *Thunberg* specimens to discover if any specimens bear clear evidence that they were studied by Linn. fil. There are no relevant specimens in the Linnaean Herbarium, so the Directors of the Herbaria at Uppsala and Stockholm were approached. Uppsala Herbarium does not send *Thunberg* specimens on loan, but the Director informs me that there are three relevant sheets in the *Thunberg* Herbarium. One of these is named *Echites succulenta*. It has linear leaves, tomentose on the underside and the corolla is badly pressed but is probably hypocrateriform. This specimen bears a determination by N. E. Brown: "*Pachypodium succulentum* A.DC." The other two sheets are named *Echites bispinosa* and are designated  $\alpha$  and  $\beta$ . The determination of the first one was confirmed by N. E. Brown. It consists of a specimen with lanceolate leaves which are sparingly hispid on the underside, while the flowers appear to be infundibuliform. On the second sheet, N. E. Brown has placed a note reading: "The specimen marked X is the only one of *E. bispinosa* on this sheet, all the others belong to *E. succulenta* and have probably been mounted here by mistake". None of the specimens bear any indication of having been studied by the younger Linnaeus.

The Director of the Stockholm Herbarium kindly sent us their specimens on loan. Five sheets were received, four of which consisted of solitary specimens collected by *Thunberg*, while the fifth was a mixed sheet with one *Thunberg* specimen and two Sparrman specimens. None of them show any annotation by Linn. fil. and therefore for purposes of selecting lectotypes they would have the same standing as the Uppsala specimens. As I have seen the Stockholm specimens, the following lectotypes are proposed:

*Pachypodium succulentum* (Linn. f.) A.DC. Lectotype: The sheet in Stockholm leg. *Thunberg*, Cap. b. Spei, on which is written at the back of the sheet: "Echites (succulenta) aculeis binis extrafoliaceis, foliis linearibus subtus tomentosis, corollis infundibuliformibus". The corolla of the specimen is, in fact, hypocrateriform, and matches what we have been accustomed to calling *Pachypodium succulentum*.

*Pachypodium bispinosum* (Linn. f.) A.DC. Lectotype: The sheet in Stockholm leg. *Thunberg*, Cap. b. Spei, on which is written at the back of the sheet: "Echites (bispinosa) aculeis binis extrafoliaceis, foliis lanceolatis glabris, corollis hypocrateriformibus". The corolla is, in this case, clearly infundibuliform and the specimen matches what we have been accustomed to calling *Pachypodium bispinosum*.

The other two Stockholm sheets consist each of a somewhat scrappy *Thunberg* specimen annotated *Echites bispinosa*, both of which are what we are calling *Pachypodium succulentum*. The sheets in Stockholm thus agree in essentials with those at Uppsala, i.e., two specimens (one of each species) are named in accordance with modern usage, while two are wrongly named. If the first two are selected as lectotypes, the



application of epithets will continue as at present, which agrees with the emendation made by E. Meyer. It is probable that the confusion in the published description by Linn. fil. resulted from an error in transcription and is not due to flowers of one species having been mounted in juxtaposition with a vegetative portion of the other species.

#### STROPHANTHUS

*Strophanthus luteolus* L. E. Codd, sp. nov., *S. petersiano* Klotzsch affinis. sed floribus parvioribus, calyce angustiori. ramulis calyce corolla pubescentibus differt.

Frutex sarmentosus 3–8 m altus, ramulis junioribus pubescentibus sparse lenticellatis. *Folia* brevissime petiolata ovato-elliptica vel oblongo-elliptica 2.5–4.5 cm longa 1–1.5 cm lata, apice acuta vel rotundata, sparse pubescentia deinde glabrescentia. *Cymae* in ramis abbreviatis terminales, tomentosae, 1–3-florae; bracteae lineares 9–10 mm longae. *Calyx* tomentosus; sepala lanceolato-linearia 1–1.3 cm longa. *Corolla* luteola extus purpureo-striata dense puberula; tubi pars infra stamina cylindrata 6 mm longa, supra stamina infundibuliformis 7 mm longa 7–9 mm lata; lobi basi ovato-lanceolati in caudas lineares attenuati 5–8 cm longi; faucium squamae lanceolatae 2.5 mm longae. *Antherae* lanceolatae sagittatae acuminatae 3.5–4 mm longae. *Ovarium* dense pubescente. *Folliculi* anguste fusiformes fusco-brunnei lenticellati 22 cm longi 1.5 cm diam.

TRANSVAAL.—Soutpansberg: Wylliespoort, flowering September, 1960, *Hardy and Wells* 359 (PRE, holotype); near the Salt Pan, fruiting September, 1960, *Hardy* 350.

NATAL.—Ingwavuma: Maputaland, flowering June, 1914, *Maputa Expedition* in TM 14460; Mkuzi–Maputa areas, flowering December 1945, *Bell Marley* in NH 40920; Ndumu Game Reserve, flowering October 1959, *Tinley* 499.

Scandent shrub or climber 3–8 m high; branchlets shortly crisped-tomentose, glabrescent with age; bark reddish-brown, lenticellate. *Leaves* shortly petioled, drying dark green or brownish above, paler below, subglabrous or sparingly pubescent with scattered hairs along the midrib and margin, eventually glabrescent, ovate-elliptic to elliptic-oblong, 2.5–4.5 cm long and 1–1.5 cm broad, base obtuse to acute, apex acute to rounded, occasionally emarginate; margin incurved; secondary nerves 4–6 on each side, distinct; petiole 2–4 mm long; axillary glands small, tooth-like. *Inflorescence* terminal, usually on short lateral shoots, 1–3-flowered, pubescent; bracts linear, acute, 9–10 mm long, pubescent; pedicels 7–10 mm long, crisped-tomentose. *Flowers* yellowish with purple markings in the throat and on the outside of the tube. *Calyx* 1–1.3 cm long; sepals linear-lanceolate, tapering gradually to the apex, shortly pubescent. *Corolla* shortly and densely pubescent without and within; tube subcylindric for 6 mm then widening gradually to a funnel-shaped portion 7 mm long and 7–9 mm broad at the mouth; lobes lanceolate at the base, attenuate into linear-filiform appendages, pendulous, 5–8 cm long, shortly pubescent on both surfaces; throat scales lanceolate, 2.5 mm long. *Stamens* included; filaments thick, 1 mm long, pubescent; anthers connivent, lanceolate, 3.5–4 mm long, acuminate, shortly apiculate, sagittate, polliniferous in the upper half, hairy on the back. *Ovary* of two free carpels, densely pubescent; style 7–8 mm long; stigma enclosed by the anthers, capitate, with a reflexed frill at the base. *Follicles* narrowly spindle-shaped, reddish-brown, about 22 cm long and 1.5 cm in diam., lenticellate, tapering gradually then abruptly thickened at the apex.

Although superficially resembling *S. gerrardii* Stapf and *S. petersianus* Klotzsch, *S. luteolus* differs from both these species in the pubescent twigs and flower parts. From *S. gerrardii* it differs, in addition, in the longer calyx and erect, not recurved, sepals, while from *S. petersianus* it differs in the smaller, differently coloured corolla and the narrower sepals, as well as in leaf size and shape. It does not run to any species in Gilg's monograph on *Strophanthus* (Engler, Monogr. Afr. Pfl. Fam. vii, Stroph.



1903), nor in Stapf's treatment in Flora of Tropical Africa. Among more recently described species, it appears to come nearest to *S. hirsutus* H. Hess in Ber. Schweiz. Bot. Ges. 62: 88 (1952), based on specimens collected in Angola, but differs in several important characters, for example, the longer calyx, the more funnel-shaped corolla tube and the pubescence of the leaves, which is never densely tomentose on both surfaces as in *S. hirsutus*. A duplicate of Tinley 499 was sent to Mr. Marais at Kew who reports that it is not matched in the Herbarium of the Royal Botanic Gardens.

The species is known from three gatherings in Maputaland, the north-eastern extremity of Zululand, and from recent gatherings in the Soutpansberg. In Maputaland it is found in coastal forest, climbing into the canopy, while in the Soutpansberg it grows on relatively dry, wooded hillsides, producing numerous slender stems which climb when they find the support of shrubs or trees. The older stems do not produce corky, winged out-growths, as is the case with *S. gerrardii*. The flowers are creamy-yellow, with a purplish tinge in the throat and on the outside of the corolla tube.

L. E. CODD

## ARACEAE

*Zantedeschia jucunda* C. Letty, sp. nov., *Z. pentlandii* (Whyte ex Watson) Wittm. affinis, sed ita differt: folia trianguli-hastata dense maculata sub-conduplicata, spatha saturatio lutea interdum intus rugosa subregulariter infundibuliformis ad fauces valde aperta apice in acumen subulatum attenuata.

*Planta* decidua habitu rigido. *Folia* glabra, petiolis 24 cm longis glabris, laminis saturate viridibus maculatis 17–30 cm longis 5–15 cm latis trianguli-hastatis acutis apice subulatis subconduplicatis, lobis basalibus obtusis interdum acutis sursum patentibus ad 14 cm longis basi 7 cm latis. *Pedunculus* foliis aequalis vel longior glabrus viridis. *Spatha* 10–16 cm longa, intus saturate lutea leviter rugosa macula purpurea, extus saturate lutea, limbo subhorizontaliter patenti in acumen subulatum ad 1·5 cm longum attenuato. *Spadix* ad dimidium longitudinis spathae attingens cylindratus obtusus. *Ovaria* c.24 subglobosa angulata sessilia, stigmatibus 0·5 mm longo sessili discoideo, staminodiis nullis. *Antherae* luteae.

TRANSVAAL.—Lydenburg: Lulu mountains, Sekukuniland, *Barnard and Mogg* 991 (PRE, holotype); Schoonoord, west slope of Lulu mountains, *du Plessis* in PRE 28835; *Barnard* 180; summit of Lulu mountains *Barnard* 181; Magnet Heights, *Thompson* in PRE 28836 (cult).

*Description*.—Plant deciduous, up to 60 cm high, glabrous, fairly rigid in habit. *Leaves* with petiole 24 cm long; blade dark green, densely maculate with elongate-white translucent spots, 17–30 cm long, 5–15 cm broad, triangular-hastate, acute with a subulate tip, semi-folded along the midrib; basal lobes obtuse or sometimes acute, upwardly spreading, up to 14 cm long, 7 cm broad at the base often smaller and narrower. *Peduncle* as long as, or longer than, the leaves, glabrous, green. *Spathes* 10–16 cm long, deep yellow with a purple blotch, slightly rugose within, deep yellow without; limb sub-horizontally spreading, tapering to a subulate green tip up to 1·5 cm long. *Spadix* up to half as long as the spathe, sometimes longer, cylindric obtuse. *Ovaries* sub-globose angled from pressure, sessile about 24 in number; stigma 0·5 mm long, sessile, discoid; staminodes none. *Anthers* yellow.

Specimens of this most striking *Zantedeschia* from Sekukuniland have been sent, from time to time, to the National Herbarium, Pretoria, since 1934. The first arrived in November 1934 from Mr. W. G. Barnard (No. 180) and further material was received in January 1939, collected by Barnard and Mogg (No. 991). In 1954 living material was sent in by Miss S. Thompson of Haenertsburg, grown from plants collected at Magnet Heights. The Native Commissioner, Schoonoord, kindly supplied plants in

February 1955 which flowered in Pretoria in January 1956 and in December of the following year further material from Schoonoord was received from Mr. S. S. du Plessis.

The species has been named *Z. jucunda* because of the pleasing appearance of the plants with deep green copiously spotted leaves and the almost campanulate spathe being brilliant deep yellow both without and within. Its distribution seems restricted to the Schoonoord-Magnet Heights region of the Lulu mountains, Sekukuniland, where it flowers from November to January.

It is most nearly related to *Z. pentlandii* (Whyte ex Watson) Wittm. and *Z. tropicalis* (N.E. Br.) C. Letty. It differs from the former in having triangular-hastate copiously spotted leaves with upwardly spreading basal lobes and an acute tip, the spathe a deeper yellow without and within and sometimes rugose within, and in the limb more spreading and tapering to a subulate tip, whereas *Z. pentlandii* has immaculate (very rarely spotted) oblong lanceolate leaves, slightly constricted above the short sagittate rounded basal lobes, apex obtuse, sometimes acute, with subulate tip, the spathe regularly funnel-shaped, limb lighter in colour, greenish outside, more suddenly rounded into the subulate tip. *Z. jucunda* can be distinguished from *Z. tropicalis* in its less luxuriant growth, stiffer, more inwardly folded triangular leaves, but chiefly in the less tightly rolled, consistently more brilliantly yellow more tapering spathes, whereas *Z. tropicalis* shows white, cream or salmon pink colour variations, but is never deep yellow.

***Zantedeschia tropicalis*** (N.E. Br.) C. Letty, stat. nov., *Richardia melanoleuca* Hook. f. var. *tropicalis* N.E. Br. in Fl. Trop. Afr. 8: 168 (1901). *Zantedeschia melanoleuca* Hook. f. var. *tropicalis* (N.E. Br.) Traub in Plant Life 4: 24 (1948). Lectotype: Nyasaland: Namasi, Cameron s.n. (K) (2 sheets).

On studying a series of plants of *Zantedeschia melanoleuca* var. *tropicalis* both in the veld and preserved, the differences between these plants and typical *Z. melanoleuca* seemed important enough to warrant raising the variety to specific rank. Whereas *Z. melanoleuca* seems to be restricted to the coastal regions of Natal, *Z. tropicalis* occurs from Nyasaland through Southern Rhodesia into the Transvaal to Potgietersrus, Letaba and Barberton and to the Mbabane district of Swaziland.

It differs from *Z. melanoleuca* in being more robust, petioles glabrous, leaf blades longer and more triangular-hastate, up to 30 cm long and 30 cm across the basal lobes from tip to tip, lobes spreading, obtuse; spathe larger, cream, pale yellow or suffused with red, up to 14 cm long, tube sub-cylindric, closed; spadix with many (up to 12 rows) of ovules. Its habitat is at forest margins or in bush in partial shade and its flowering reaches its peak during December and January.

NYASALAND.—Namasi, 1897, Cameron s.n. (K!); Nivera Hill, Benson 81.

SOUTHERN RHODESIA.—Mashonaland, Six mile spruit, Salisbury, Lady Evelyn Cecil in K. 149; Melsetter, Crook in PRE 28828; Mount Silinda, Obermeyer in PRE 28827.

TRANSVAAL.—Soutpansberg: 4½ miles N.E. of Louis Trichardt, Codd 8326; Entabeni Forestry Station, Codd 8400; four miles N. of Louis Trichardt on Messina road, Admiraal in PRE 28830; Pietersburg: one mile N. of Haenertsburg, Codd 8415; on farm Wellstead, Thompson in PRE 28826; Magoebaskloof, fld. Pretoria, O'Connor in PRE 28825; one mile E. of Haenertsburg, Reynolds 5806a; 5806b; Woodbush, Mogg in PRE 28832; Mohlakeng, Blaauwberg, Codd 9148; Letaba: Tzaneen, Rogers, 12501; Duivelskloof, Haar in PRE 28832; The Downs, Murray, PRE 28833; Barberton: Kaapmuiden, Mogg in PRE 28834; Louw's Creek, Bragshaw 110; eight miles S.E. of Barberton on Havelock Road, Codd 8159.

SWAZILAND.—Mbabane: Little Usutu valley, Compton 25405.

CYTHNA LETTY

## EBENACEAE

## NEW COMBINATIONS IN THE GENUS DIOSPYROS

In Bothalia 7, 1: 17-19 (1958) a number of new combinations were made in the genus *Royena*. A short while after these notes were submitted for publication and too late for withdrawal, it was discovered that White (Oxford Univ. Forest Soc. Journ. 4, 6: 31-34, 1958) had come to the conclusion that the genus *Royena* could not be regarded as distinct from *Diospyros*. After some correspondence the author decided to follow White in uniting the two genera. Characters previously used for distinguishing *Royena* from *Diospyros* have proved to break down when the latter is studied on a worldwide scale. As pointed out in Bothalia 1.c., *Royena* cannot be regarded as truly hermaphrodite, and the main difference given in the keys by various authors thus cannot be used. Attempts were made to associate a number of characters which in combination could be used to distinguish the two genera. However, as pointed out by White, this results in a classification in which some closely related species will fall in separate genera even though not closely related to the other species in the genus in which they are placed. For these reasons the genus *Royena* is now united with *Diospyros*. The following combinations are necessary.

**Diospyros acocksii** (de Winter) de Winter comb. nov. *Royena acocksii* de Winter in Bothalia 7, 1: 18 (1958).

**Diospyros austro-africana** de Winter nom. nov. *Royena hirsuta* L. Sp. Pl. ed. 1: 397 (1753).

(a) var. **austro-africana**. *Royena hirsuta* L. Sp. Pl. ed. 1: 397 (1753) non *Diospyros hirsuta* L. f. Suppl. 440 (1781); *Royena angustifolia* Willd. Sp. Pl. 2: 633 (1800) non *Diospyros angustifolia* Audib. ex Spach, Hist. Veg. Phan. 9: 405 (1843); *Diospyros hirsuta* Desf. in Ann. Mus. Par. 4: 449, t.62 f.2 (1805) non Linn. f. Suppl. 440 (1781).

(b) var. **rugosa** (E. Mey. ex A. DC.) de Winter comb. et stat. nov. *Royena rugosa* E. Mey. ex A. DC. Prod. 8: 212 (1844) non *Diospyros rugosa* Sap. in Ann. Sc. Nat. 4, 17: 264, t.11 f.3 (1862) (fossil species). *Royena hirsuta* L. var. *rugosa* (E. Mey. ex A. DC.) Zahlbr. in Ann. Naturhist. Hofmus. Wien. 28: 397 (1903).

(c) var. **microphylla** (Burch.) de Winter comb. et stat. nov. *Royena microphylla* Burch. Trav. 1: 348 (1822) non *Diospyros microphylla* Bedd. Forest Man. 145 (1870); *Royena hirsuta* L. var. *microphylla* (Burch.) de Winter in Bothalia 7, 1: 18 (1958).

(d) var. **rubriflora** (de Winter) de Winter comb. nov. *Royena hirsuta* L. var. *rubriflora* de Winter in Bothalia 7, 1: 18 (1958).

As can be seen from the references under the varieties given above all the epithets available for re-combination in *Diospyros* were already occupied in this genus, and it was necessary to give a specific new name.

**Diospyros galpinii** (Hiern) de Winter comb. nov. *Royena galpinii* Hiern in F.C. 4, 1: 450 (1906).

**Diospyros glabra** (L.) de Winter comb. nov. *Royena glabra* L. Sp. Pl. 1: 397 (1753).

**Diospyros glandulifera** de Winter nom. nov. *Royena glandulosa* Harv. ex Hiern in Trans. Camb. Phil. Soc. 12: 89, t.2 (1873) non *Diospyros glandulosa* Lace in Kew Bull. 349 (1915).

**Diospyros lycioides** Desf. in Ann. Mus. Par. 6: 448, t.62 f.1 (1805).

(a) subsp. **lycioides**. *Royena lycioides* (Desf.) A. DC. Prod. 8: 214 (1844).

(b) subsp. **sericea** (Bernh.) de Winter comb. et stat. nov. *Royena sericea* Bernh. ex Krauss in Flora 27: 824 (1844); *Royena lycioides* (Desf.) A. DC. subsp. *sericea* (Bernh.) de Winter in Fl. Pl. Afr. 32, 3: t.1262 (1958).



- (c) subsp. **guerkei** (O. Ktze.) de Winter comb. et stat. nov. *Royena guerkei* O. Ktze. Rev. Gen. Pl. 3, 2: 196 (1898); *Royena lycioides* (Desf.) A. DC. subsp. *guerkei* de Winter in Bothalia 7, 1: 17 (1958).
- (d) subsp. **nitens** (Harv. ex Hiern) de Winter comb. et stat. nov. *Royena nitens* Harv. ex Hiern in Trans. Cambr. Phil. Soc. 12: 87 (1872); *Royena lycioides* (Desf.) A. DC. subsp. *nitens* (Harv. ex Hiern) de Winter in Bothalia 7, 1: 18 (1958).

**Diospyros ramulosa** (E. Mey. ex A. DC.) de Winter comb. nov. *Royena ramulosa* E. Mey. ex. A. DC. Prod. 8: 212 (1844).

**Diospyros scabrida** (Harv. ex Hiern) de Winter comb. nov. *Royena scabrida* Harv. ex Hiern. in Trans. Cambr. Phil. Soc. 12: 82 (1872).

(a) var. **scabrida**.

(b) var. **cordata** (E. Mey. ex A. DC.) de Winter comb. et stat. nov. *Royena cordata* E. Mey. ex A. DC. Prod. 8: 211 (1844) non *Diospyros cordata* (Hiern) Bakhuijzen in Gard. Bull. Straits Settlements 7: 167 (1933); *R. opaca* E. Mey. ex A. DC. Prod. 8: 211 (1844) non *Diospyros opaca* C.B. Cl. in Hook. f. Fl. Brit. Ind. 3: 567 (1882).

Both the epithets *cordata* and *opaca* are older than the epithet *scabrida*, but are already occupied in *Diospyros* hence the next available epithet *scabrida* was used. The epithet *cordata* has been used for the variety (b) to insure continuity and avoid more confusion although both varieties have cordate leaves.

**Diospyros simii** (O. Ktze.) de Winter comb. nov. *Royena simii* O. Ktze. Rev. Gen. Pl. 3, 2: 196 (1898).

**Diospyros villosa** (L.) de Winter comb. nov. *Royena villosa* L. Syst. Nat. 12, 2: 302 (1767).

var. **parvifolia** (de Winter) de Winter comb. nov. *Royena villosa* L. var. *parvifolia* de Winter in Bothalia 7, 1: 18 (1958).

**D. whyteana** (Hiern) F. White comb. nov. *Royena whyteana* Hiern in Trans. Linn. Soc. 2, 4: 25 (1894).

**D. pallens** (Thunb.) F. White comb. nov. *Royena pallens* Thunb. Prod. 80 (1794).

B. DE WINTER AND F. WHITE

## GENTIANACEAE

### CHIRONIA

**Chironia stokoei** Verdoorn sp. nov., *C. jasminoidei* affinis sed ab ea et ab aliis speciebus stigmatibus peltatis, praesertim floribus basi bi-bracteatis differt.

Suffrutex rigidus, ascendens, 30–50 cm altus; caules superne ramosi et foliolati inferne saepe nudi nodis prominentibus. *Folia* coriacea, paulo corrugata, elliptica nunc late nunc angustate elliptica, interdum ovate vel lanceolata-elliptica, 1·7–3·5 cm longa, 0·5–1·8 cm lata, obtusa vel acuta, marginibus anguste revolutis. *Cymae* terminales, monochasiales, 3-florae vel ad florem solitarium reductae; pedicelli breves vel 0; *flores* basi bi-bracteati; bracteae 6–18 mm longae basi 1·3–4 mm latae, acuminate, obtusae vel acutae. *Calyx* 9–16 mm longus infra medium lobatus; lobi a basi acuminati, obtusi vel acuti, obscure carinati. *Corolla* “magenta pink” (perraro alba), 2·2–2·8 cm longa; tubus submembranaceus, c. 1·2 cm longus in faucibus leviter constrictus apice ampliatus; lobi elliptici vel subrotundi, basi breviter cuneato-unguiculares, 1·2–1·8 cm longi, 0·8–1·1 cm lati. *Stamina* paulo infra fauces inserta



filamentis c. 1 cm longis, antheris c. 4 mm longis non tortilibus. *Ovarium* c. 1 cm longum, in stylum attenuatum; stylus quam ovarium brevior c. 8 mm longus; stigmatibus peltatis apice crasse stigmatosis.

CAPE.—Somerset West: Sneeuwkop, *Stokoe* 7986 (BOL); between Sneeuwkop and Landdrost Kop, *Stokoe* 9211 (BOL). Caledon: Kogelberg, *Stokoe* 1003 (PRE, holo.); 1003b; *Stokoe* in Bol. Herb. 17705; *Stokoe* in S.A. Museum Herb. 66894; Palmiet River mountains, *Stokoe* 982; mountains S. of Sir Lowry's Pass, *Stokoe* in S.A. Museum Herb. 66893; Klein River mountains *Stokoe* in S.A. Museum 64199.

Rigid ascending suffrutices, 30–50 cm tall; stems leafy and branched above, leafless below with prominent nodes, branches and leaves notate with shiny, microscopic, subcutaneous cells. *Leaves* coriaceous, somewhat corrugated on both surfaces, from broadly to narrowly elliptic, sometimes oblong-, ovate- or lanceolate-elliptic, 1.7–3.5 cm long, 0.5–1.8 cm broad, rounded or acute at the apex, margins narrowly revolute. *Cymes* terminal, monochasial, 3-flowered or reduced to a solitary flower; pedicels short or 0; *flowers* bi-bracteate at the base; bracts 6–18 mm long, 1.3–4 mm broad at the base, gradually narrowing to an obtuse or acute apex. *Calyx* 9–16 mm long, divided beyond the middle; lobes gradually narrowing from a broad base to an obtuse or acute apex, obscurely carinate. *Corolla* “magenta pink” (rarely white), 2.2–2.8 cm long; tube rather thin textured, slightly narrowed in the throat and widened at the mouth, about 1.2 cm long; lobes elliptic to subrotund and cuneate into a claw-like base, usually obviously longer than broad, 1.2–1.8 cm long, 0.8–1.1 cm broad. *Stamens* inserted just below the throat; filaments about 4 mm long; anthers about 4 mm long, not spirally twisted. *Ovary* about 1 cm long, attenuating into the style; style shorter than the ovary, about 8 mm long, stigma peltate, thickly stigmatose on top.

When revising the genus *Chironia* for the Flora of Southern Africa this species was found to be represented in three herbaria, the Marloth Herbarium (now in the National Herbarium, Pretoria), the Bolus Herbarium and the Herbarium of the South African Museum (now at the Herbarium of the National Botanic Gardens, Kirstenbosch). All the specimens, nine in number, were collected by Mr. T. P. Stokoe over a range of about 30 years. The earliest date was August 1924 and the most recent September 1953. The specimens all came from mountainous country in the Somerset West and Caledon districts. Unfortunately Mr. Stokoe although a great collector, never claimed to have an eye for recognizing species. It was after his 91st birthday (3.3.1959) and just after he had returned from his last trip to the Hottentots Holland that he was informed of this new species and that it was to be called after him. Had he lived he would most probably have made a point of investigating it for us. But his great usefulness to botanists came to a regretted end when he died in April 1959.

*Chironia stokoei* differs from all the other species with simple styles and a terminal stigmatic surface, in that the flowers are bi-bracteate at the base. In general it is nearest *C. jasminoides* but can be distinguished by the calyx-lobes which are never long attenuate at the apex and the shorter and broader leaves besides the bracts at the base of the flowers. In the prominent nodes on the almost leafless lower portion of the stem it resembles *C. arenaria*, but besides having basal bracts it differs in the corolla-lobes being longer than broad and the leaves usually broadly elliptic.

#### CHIRONIA LINOIDES COMPLEX

*C. linoides* Linn. Aggregate species.

*C. linoides* Linn. subsp. *linoides*. Lectotype: specimen cited in Hort. Cliff. p. 54, No. 1. *C. linoides* Sp. Pl. ed. 1: 189 (1753); Prain in Kew Bull. 1908: 349 and 353 (1908); Hill & Prain in F.C. 4, 1: 1103 (1909). Syntypes: specimen cited in Hort. Cliff. p. 54, No. 1; specimen in Roy. Lugab. 433; and figure in Breyn. Cent. p. 175, t. 90/1678.

[The lectotype is nominated on the evidence of Prain (Kew Bull. 1908: 353) that the two specimens mentioned still exist and are both typical of the species. The first mentioned by Linnaeus is here chosen.]

***Chironia linoides* Linn. subsp. *nana* Verdoorn, nom. nov.** Type: Cape Flats, *Ecklon* 642 (SAM, holo!).

*C. gracilis* Salisbury ex Prain in Kew Bull. 1908: 293 (1908), non Michx. (1803).  
Syntypes: many specimens including *Ecklon* 642 from the Cape Flats.

***C. linoides* Linn. subsp. *macrocalyx* (Prain) Verdoorn, stat. nov., comb. nov.** Lectotype: Cape Flats, *Ecklon* 644 (SAM, iso!).

*C. gracilis* var. *macrocalyx* Prain in Kew Bull., 1908: 294 (1908). Syntypes: several specimens including *Ecklon* 644 from the Cape Flats.

***C. linoides* Linn. subsp. *emarginata* (Jarosz) Verdoorn, stat. nov.**

*C. emarginata* Jarosz, Pl. Nov. Cap.: 11 (1821). Type: Peninsula, *Berg* s.n.

From the synonymy in the Flora Capensis (Vol. 4, 2: 1101–2, 1909) it can be seen that *C. emarginata* Jarosz and *C. gracilis* Salisb. ex Prain have both at some time or another been classified as *C. linoides* or a variety or form of that species or one of its synonyms. Hill and Prain separated these closely related specimens into four categories, *C. linoides*, *C. emarginata*, *C. gracilis* and *C. gracilis* var. *macrocalyx*. After examining the material now in the South African herbaria it was found that a fair percentage of this large number of specimens can, on sight, be sorted into one or other of these taxa. But there remains a significant assortment of intermediates (some may be hybrids) that do not fit exactly into any one of these. This seems to indicate that, to accommodate these intermediates, a far more workable treatment would be to look upon the whole group as belonging to one complex species, *C. linoides*, comprising four subspecies and their intermediates. The necessary combinations are made above.

The lectotype nominated for subsp. *macrocalyx* was selected because a duplicate of one of the syntypes of the species was seen in a South African herbarium and was found to answer very well to the original description.

#### CHIRONIA PALUSTRIS COMPLEX

***C. palustris* Burch., aggregate species.**

***C. palustris* Burch. subsp. *palustris*.** Type: Griquatown, *Burchell* 1925.

*C. palustris* Burch. Trav. 2: 226 (1824); Hill and Prain in F.C. 4, 1: 1106 (1909).  
Type: Griquatown, *Burchell* 1925.—var. *foliata* (Griseb.) Prain in l.l. (1909).—  
var. *radicata* (E. Mey.) Schoch in Bot. Centralbl. Beih. 14: 234 (1903). *Plocandra*  
*albens* E. Mey. Comm. 182 (1837). Type: Between Kachu and Zandplaat, *Drege*.—  
var. *radicata* E. Mey. l.c. (1837). Type: Mooyplaats, *Drege*. *P. palustris* (Burch.)  
Griseb. in D.C. Prod. 9: 43 (1845).—var. *foliata* Griseb. in l.c. (1845). Type:  
Caffraria, *Drege*.

***C. palustris* subsp. *rosacea* (Gilg) Verdoorn.** Type: Cape, Pondoland, *Bachmann* 1038.

*C. rosacea* Gilg in Bot. Jahrb. 26: 104 (1899); Schoch in Bot. Centralbl. Beih. 14: 229 (1903) partly as to Natal specimen; Hill and Prain in F.C. 4, 1: 1105 (1909).

*C. maxima* Schoch in Bull. Herb. Boiss. 2nd ser. 2: 1014 (1902). Type: Tugela Riv. Wood (Z).

***C. palustris* subsp. *transvaalensis* (Gilg) Verdoorn.** Type: Lydenburg, *Wilms* 974.

*C. transvaalensis* Gilg in Bot. Jahrb. 26: 106 (1899); Schoch in Bot. Centralbl. Beih. 14: 227 (1903).

The specimens classified under *C. palustris* Burch., *C. rosacea* Gilg and *C. transvaalensis* Gilg, in the Flora Capensis are obviously closely related. The inflorescences

and flowers, especially, are very similar, the flowers varying only in size. After examining a large number of specimens in South African herbaria and investigating the living plants in the Transvaal the decision was made to reduce these taxa to subspecific rank. Reasoning on the following lines led to this decision.

Taking the species *C. palustris* and *C. transvaalensis* first, the main distinguishing features of the most southerly unit, *C. palustris*, are that it is usually smaller in stature, the basal leaves are persistent and the cauline usually much reduced while the taller Transvaal species has well developed cauline leaves and basal leaves which early disappear. In addition the anthers are strongly twisted in *C. palustris* and only slightly so in *C. transvaalensis*. This latter difference is usually a good auxiliary distinction but being a matter of degree only, there are cases where it is not of any help.

It was noted from herbarium material that the areas of distribution of these two "species" overlap in the Transvaal. A spot near Kempton Park was visited to examine the living plants. In the turfy ground along a water course the tall *C. transvaalensis* was found with erect pairs of glaucous, linear-lanceolate cauline leaves and, at this stage, bearing no basal leaves. Nearby in a hardened patch of turf grew the smaller plant with a rosette of basal leaves pressed flat on the hardened ground and on the stem were remote pairs of much reduced leaves. The stamens were a degree more twisted than in the taller plants. The possibility of the hard condition of the ground being responsible for the differences was considered. But in the main area of distribution of the plants with basal leaves, that is the eastern Cape, no examples of plants without basal leaves have been found although the conditions of soil they seem to require probably exist in those regions too. Also in the central areas, north of Kempton Park, the plants are mostly without basal leaves and with well developed cauline leaves although hard patches of turf, in all probability, abound. So there are two sets of specimens separable on some vegetative features with separate centres of distribution. This seems to indicate that taxonomically subspecific status would be more appropriate for these two "species". From the nomenclatural angle too this status would be an advantage for in many cases where the lower portion of the plant was not collected it is difficult to decide whether the cauline leaves are small "well developed leaves" or rather large "reduced leaves". This treatment would also provide a name for some specimens from the Victoria Falls which have the leaf characteristics of subsp. *palustris* but the anther-characters of subsp. *transvaalensis*.

The third "species" in this group for similar reasons is reduced to the same rank. *C. rosacea* Gilg agrees in habit with *C. transvaalensis* but differs in having larger flowers and broader leaves. These features are merely comparative but again the distribution is on the whole distinct, *C. rosacea* occurring in Natal and *C. transvaalensis* in the central regions. In Swaziland both are found and here intermediate specimens occur. In one case one portion of the same gathering has been identified as *C. transvaalensis* and another as *C. rosacea*. But on the whole the specimens are separable into the two categories.

From *C. palustris* *C. rosacea* differs in the well developed broad cauline leaves, the disappearance of the basal leaves and the larger flowers. It also has a separate centre of distribution and so bears a similar relationship to *C. palustris* as does *C. transvaalensis*. The necessary combinations for the subspecies are made above.

#### CHIRONIA PURPURASCENS COMPLEX

- C. purpurascens* (E. Mey.) Benth. and Hook. f., aggregate species.
- C. purpurascens* (E. Mey.) Benth. and Hook. f., subsp. **purpurascens**. Type: Natal, near Umkomaas, Drege 4923.
- C. purpurascens* (E. Mey.) Benth. and Hook. f., Gen. Pl. 2: 805 (1876); Hill and Prain in F.C. 4, 1: 1108 (1909).—var. *tysonii* (Gilg) Prain in Kew Bull. 1908: 350 (1908).



—var. *inpedita* Prain 1c. Type: *Krook* 2028. *C. bachmannii* Gilg in Bot. Jahrb. 26: 103 (1898). Type: Pondoland, *Bachmann* 1037. *C. tysonii* Gilg 1c: 104 (1898). Type: near Clydesdale, *Tyson* 1290. *Plocandra purpurascens* E. Mey! Comm. 182 (1895).

*C. purpurascens* (E. Mey.) Benth. and Hook f. subsp. *humilis* (Gilg) Verdoorn stat. nov. Type: Pretoria, Aapies Riv. Zeyher 1193.

*C. humilis* Gilg in Bot. Jahrb. 26: 105 (1899); Baker and Brown in F.T.A. 4, 1: 555 (1904); Hill and Prain in F.C. 4, 1: 1107 (1909).—var. *wilmsii* (Gilg) Prain in Kew Bull. 1908: 350 (1908); Hill and Prain in F.C. 4, 1: 1107 (1909).—var. *zuluensis* Prain in Kew Bull. 1910: 55 (1910). Syntypes: Ginginhlovo *Wylie* in Herb. Wood 11, 355; without precise locality, Mrs. *McKenzie* s.n. *C. wilmsii* Gilg in Bot. Jahrb. 26: 105 (1899). Type: Bronkhorstspuit, *Wilms* 973.

A study of the species of *Chironia* shows that *C. purpurascens* (E. Mey.) Benth. and Hook. f. and *C. humilis* Gilg are more closely related to each other than to any of the rest of the species. In the Flora Capensis this is borne out by Hill and Prain who put these two "species" in a section by themselves. To the distinguishing characters which they use for the section, namely the deeply cut calyx, short corolla-tube, distinctly spirally twisted anthers and pointed fruits, may be added the following features shared by the two "species", the deep colour of the flowers (usually magenta pink); the acicular apical half of the calyx-lobes and bracts; and the central flowers of the cymes usually having a much shorter pedicel than those of the lateral. The features which separate these units are: the smaller stature of *C. humilis*, about 30 cm as against over 50 cm tall; the pedicel of its central flower usually being under 6 mm long as against being up to 25 mm long; and flowers frequently with a pair of bracts near the base of the calyx while in the taller plants they are only rarely present. These differences are principally in the size of the plant itself or certain parts of it; but the main area of distribution of the two groups is distinct; the taller plants come from the extreme eastern Cape, Natal, and Swaziland while the smaller plants are recorded from Zululand (northern Natal), the Transvaal and northwards to Southern Rhodesia.

These findings indicate that the relationship which the two groups bear to each other is rather subspecific than specific and *C. humilis* is therefore here reduced to a subspecies under *C. purpurascens* which is the older name.

#### ENICOSTEMMA

*Enicostema hyssopifolium* (Willd.) Verdoorn comb. nov. Type: specimen 328.30 (Fabricius) in Linnean Herbarium (L, lecto.; PRE, photo.).

*Exacum hyssopifolium* Willd. Spec. 1: 640 (1798). Name for *Gentiana verticillata* (non Linn.) Linn. f.

*Gentiana verticillata* (non Linn. 1753) Linn. f. Suppl.: 174 (1781) applied when naming a Fabricius specimen from India; Vahl. Symb. 3: 46 (1794) partly as to Indian and Arabian references. *G. verticillaris* (sic) Linn. var.  $\beta$ . Retz. Obs. Bot. 2: 15 (1781) based on a König specimen.

*Hippion hyssopifolium* (Willd.) Spreng. Syst. 1: 589 (1824).

*Enicostema littorale* Blume, Bijdr. 848 (1826). Type: *Blume*, Java.

*E. verticillare* (Retz.) Baill. Hist. Pl. 10: 131 (1891) partly.

*E. verticillatum* Engl. in Pfl. Cat. Afr. C: 313 (1895) as to specimens cited.

*Lepinema verticillata* Raf., Fl. Tellur. 3: 26 (1837) partly as to Vahl reference.

*Adenema hyssopifolium* (Willd.) G. Don. Gen. Syst. 4: 201 (1837).

*Slevogtia verticillata* D. Don. in Trans. Linn. Soc. 17: 532 (1837) nom illeg. based on *Gentiana verticillata* Linn. fil.; *S. orientalis* Griseb. in DC. Prod. 9: 65 (1845), nom illeg.



*Hippionum verticillatum* O. Ktze. Rev. Gen. Pl. 428 (1891) for the greater part, excluding the American reference.

Lectotype: I nominate the Fabricius specimen No. 328.30 in the Linnean Herbarium as the lectotype of *Enicostema hyssopifolium* (Willd.) Verdoorn. Willdenow's first reference under *Exacum hyssopifolium* is "Linn. f. Suppl. 174", where the Fabricius specimen from India is described.

The first record of this species was that of Linnaeus filius in the Supplementum 1781 when describing a Fabricius specimen from India. It was classified by him as *Gentiana verticillata* Linn., an American species. Willdenow in 1798 recognized this as an error and not only distinguished between the American and Indian specimens but transferred them both to the genus *Exacum*. The American plants he placed under *Exacum verticillatum* (L.) Willd. and gave the name of *Exacum hyssopifolium* to the specimen recorded by the younger Linnaeus in Supplementum. No mention is made by Linnaeus or Willdenow of the unusual double hooded gland at the base of the filaments. This has proved to be a diagnostic character and in 1826 Blume described the genus *Enicostema* meaning "singular stamen" for a specimen from Java. Independently three other genera were described to take the same taxon, but *Enicostema* is the earliest legitimate generic name. This name is therefore combined above with the earliest legitimate specific epithet "hyssopifolium" of Willdenow.

I. C. VERDOORN

#### SEBAEA

**Sebaea fourcadei** W. Marais sp. nov. *S. ramosissimae* affinis sed inflorescentia compactiore, calycis segmentis stramineis fragilibus, corollae lobis quam tubum longioribus differt.

Herba annua, gracilis, erecta ad 25 cm alta. *Caulis* simplex vel basi ramosus. *Folia* ovato-orbiculata vel superne ovata, ad 1 cm longa, 1 cm lata, obtusa vel subacuta, paribus paucibus, internodiis longis. *Inflorescentia* corymbosa, pauci- vel pluriflora. *Calyx* 5-fidus; segmenta 4.75–5 mm longa, 1–1.5 mm lata, lanceolata vel elliptico-lanceolata, acuminata mucronata, carinata, marginibus membranaceo-opacis, fragilibus. *Corolla* flava; tubus 3–4 mm longus; lobi 2.75–3.5 mm longi, 1–1.25 mm lati, anguste-elliptici vel anguste ovato-elliptici, oblanceolati, obtusi, nonnumquam leviter cucullati. *Filamenta* 0.25 mm longa in faucibus inserta; anthera 0.875–1.25 mm longa, glandulis 3 parvis flavis globosis breviter stipitatis ornata. *Stylus* 2.75–3.75 mm longus, infra vel plus minus medio callo instructus stigmate capitato 2-lobato.

CAPE.—Knysna: Belvedere, Duthie 1175 (K). Humansdorp: Geelhoutboom. Fourcade 4880 (K, holo!).

Slender, erect, annual herbs, simple or branched near the base, up to 25 cm high. *Leaves* up to 1 cm long and 1 cm broad, ovate-orbicular or the upper ones ovate, obtuse or subacute, in relatively few pairs, the lower ones, soon dying off; internodes long. *Inflorescence* corymbose, few to several flowered. *Calyx* of 5 segments each 4.75–5 mm long, 1–1.5 mm broad, lanceolate or elliptic-lanceolate, acuminate-mucronate, their sides membranous-opaque, brittle and strawlike when dry, keeled. *Corolla* yellow; tube 3–5 mm long; lobes 2.75–3.5 mm long, 1–1.25 mm broad, narrowly-elliptic or narrowly ovate-elliptic to oblanceolate, rounded, sometimes slightly cucullate. *Filaments* 0.25 mm long, inserted in the corolla-sinuses. *Anthers* 0.875–1.25 mm long, each with three small round, shortly stipitate, pale yellow glands. *Style* and *stigma* 2.75–3.75 mm long, with a stigmatic swelling below or near the middle; stigma capitate, 2-lobed.

**S. capitata** Cham. et Schlechtld. var. **sclerosepala** (Schinz) Marais, stat. nov.

Basionym: *S. sclerosepala* Gilg ex Schinz in Mitt. Geogr. Ges. Lübeck 17: 23 (1903).

- S. micrantha* Cham. and Schlechtl. var. *intermedia* (Cham. and Schlechtl.) Marais, comb. nov.  
 Basionym: *S. cordata* var. *intermedia* Cham. and Schlechtl. in Linnaea 1: 191 (1826).
- S. Zeyheri* Schinz subsp. *acutiloba* (Schinz) Marais, stat. nov.  
 Basionym: *S. acutiloba* Schinz in Bull. Herb. Bois. 3: 412 (1895).
- S. Zeyheri* Schinz subsp. *cleistantha* (R. A. Dyer) Marais, stat. nov.  
 Basionym: *S. cleistantha* R. A. Dyer in K.B. 1933: 461.
- S. pentandra* E. Mey var. *burchellii* (Gilg) Marais, stat. nov.  
 Basionym: *S. burchellii* Gilg in Bot. Jahrb. 26: 89 (1898).
- S. sedoides* Gilg var. *confertiflora* (Schinz) Marais, stat. nov.  
 Basionym: *S. confertiflora* Schinz in Mitt. Geogr. Ges. Lübeck 17: 51 (1903).
- S. sedoides* Gilg var. *schoenlandii* (Schinz) Marais, stat. nov.  
 Basionym: *S. schoenlandii* Schinz in Bull. Herb. Boiss ser 2, 6: 741 (1906).

## LECTOTYPES IN SEBAEA

- Sebaea laxa* N.E. Br. in Kew Bull. 1901: 128 (1901).  
 Syntypes: *Burchell* 7089 and *Galpin* 4337. Lectotype: *Galpin* 4337 (K).

On the sheet of *Galpin* 4337 which N. E. Brown examined there are some dissected flowers indicating that this specimen was studied in more detail than *Burchell* 7089.

*Sebaea compacta* Hill.

Lectotype: *Barber* 21 (K). Selected because it is the best of the syntypes as far as state of preservation and amount of material is concerned.

- S. Zeyheri* Schinz subsp. *acutiloba* (Schinz) Marais.

Lectotype: *Schlechter* 3045 (K).

Schinz cites two specimens with his description of *S. acutiloba* in Bull. Herb. Boiss 3: 415 (1895), namely, *Schlechter* 3045 and *Wood* 4950, both from Clairmont, Natal. As *Schlechter*'s specimens are usually represented in several herbaria and there is only a fragment of *Wood* 4950 in the Kew Herbarium, I select the Kew sheet of *Schlechter* 3045 as lectotype.

## BELMONTIA AND EXOCHAENIUM SYNONYMOUS WITH SEBAEA

In the *Flora Capensis* (4, 2: 1057, 1909) Hill and Prain follow Schinz and sink *Belmontia* E. Mey. under *Sebaea* R. Br. while maintaining *Exochaenium* Griseb. as a distinct genus. Phillips in his *Genera of South African Flowering Plants* (1951) follows Bentham and Hooker who treat *Exochaenium* as being synonymous with *Belmontia*, which genus they maintain as distinct from *Sebaea*.

In my work on the "Flora of Southern Africa", I have come to the conclusion that both *Belmontia* and *Exochaenium* are inseparable from *Sebaea* and they will be treated as synonyms of the latter genus in the "Flora". Some of the reasons that led to this decision are as follows: The main distinguishing features between *Belmontia* and *Exochaenium* collectively on the one hand and *Sebaea* on the other, are, the presence in the former group of disc-glands between the calyx and the corolla, the style being without a two glandular swelling and the stamens included in the corolla-tube instead of being inserted in, or shortly below, the sinuses of the lobes and exerted from the tube. In several instances these characteristics have proved to be diagnostically unreliable. For instance, in the species *Sebaea thomasi*, disc-glands are sometimes present and sometimes not. Then again in *S. micrantha* and *S. exacoides*, while the stamens are included in the corolla-tube, a characteristic of *Exochaenium* and *Belmontia*, glandular swellings are present on the styles, features of *Sebaea*.

W. MARAIS

## GESNERIACEAE

*Streptocarpus rimicola* Story, sp. nov., *S. pumilo* Burtt affinis, sed stylo brevior et floribus albis differens.

Herba acaulis unifoliata, raro folio altero minimo. *Folium* plerumque c.  $4 \times 2$  cm ( $1.5 \times 1.6.5 \times 2.5$ ), late ovatum vel angustum et acuminatum, leviter serratum, chartaceum vel coriaceum, utrinque villis eglanduliferis, venis supra impressis subtus prominentibus, hypocotylis plerumque minutissimo, raro ad 1 cm longo. *Inflorescentia* villis glanduliferis et eglanduliferis, ad 7 cm alta, plerumque 3-4. *Pedunculi* numero ad 4 plerumque solitarii, quisque ad 9 plerumque 2-3 flores ferens. *Bractae* minutae. *Pedicelli* 1 ad 2.5 cm longi interdum ramosi. *Calyx* ad basin partitus, lobis  $2 \times 0.5$  mm. *Corolla* alba 1 cm longa; tubus cylindratus basi saccatus, leviter supinus, 8 mm longus 2-3 mm diam., intus glaber (crista villorum eglanduliferorum pellucidorum vel purpureo-tinctorum super antheris excepta); limbus vix obliquus, lobis orbicularibus c. 3 mm longis et latis. *Orbis* annularis leviter lobatus viridis. *Androecium* staminibus corollae basi ab 1 mm insertis; filamenta glabra pellucida 4 mm longa; staminodia 3, pariter basi ab 1 mm inserta, 2 c. 1 mm longa, 1 brevius. *Gynoeceum* ovario 2-2.5 mm longo; stylus 3-3.5 mm longus, apicem versus glaber et subito deflexus; stigma capitatum, paulum ultra antheras eminens. *Capsula* robustior, 8-10 mm longa, ad 2.5 mm lata; stylus persistens 3-3.5 mm longus.

TRANSVAAL.—Warmbaths district: Farm Groothoek 1246, western extremity of Waterberg mountains, steep south-facing mountain side, under overhanging ledges, 6,000 ft., Codd 3974; Codd 6486 (PRE, holo.); Story 6517.

A stemless unifoliate herb, rarely with a second much smaller leaf. *Leaf* dark green above, paler and sometimes reddish below, usually about  $4 \times 2$  cm (in flowering specimens ranging from  $1.5 \times 1$  to  $6.5 \times 2.5$ ), sometimes broadly ovate, sometimes narrowly oblong and acuminate, often withered at the tip, slightly serrate, chartaceous to coriaceous, with non-glandular hairs on both surfaces, veins sunken above, prominent below, hypocotyl usually not noticeable, rarely up to 1 cm long. *Inflorescence* with glandular and non-glandular hairs, up to 7 cm high but usually 3 to 4. *Peduncles* up to four but usually solitary, each bearing up to nine but usually two or three flowers. *Bracts* minute. *Pedicels* 1-2.5 cm long, sometimes branched. *Calyx* lobed to the base, lobes  $2 \times 0.5$  mm. *Corolla* white, 1 cm long; tube saccate at base, slightly curved upwards, 8 mm long, 2-3 mm diam., glabrous within except for a patch of light purple or colourless 2-celled smooth-walled; eglandular hairs above the anthers; limb scarcely oblique, lobes rounded, about 3 mm long and as wide. *Disc* annular, fleshy, slightly lobed, light green. *Androecium* with stamens inserted 1 mm from the base of the corolla-tube; filaments glabrous, colourless, 4 mm long; anthers colourless; staminodes 3, inserted 1 mm from the base of the tube, two of them about 1 mm long, the third smaller. *Gynoeceum* in freshly-opened flower with ovary 2-2.5 mm long; style 3-3.5 mm long, glabrous near the tip which is sharply bent down; stigma capitate, projecting a little beyond the anthers. *Capsule* erect, fairly stout, 8-10 mm long, up to 2.5 mm wide; style persistent, 3-3.5 mm long.

The highest peak in the Waterberg (6,841 feet) is at the western edge of the range, which at this point falls abruptly away into the sandy flats of the north-western Transvaal and the Bechuanaland Protectorate. According to available records, *Streptocarpus rimicola* occurs only on this peak, and even here the plants are apparently restricted to the southern aspect and to the sheer cliffs which make up the last three hundred feet or so. There is an annual rainfall of about 30 inches which falls mainly in summer, but the plants depend less on direct rainfall than on seepage and mist, for they grow mostly in deep shelter under rock ledges. They have so far not been found near the bottom of the cliffs, although there are as many crevices and ledges there and these provide apparently ideal conditions for their growth. Presumably there is less mist

near the bottom and therefore not enough moisture for them. It was interesting to find that the only other member of the genus recorded from this locality also has a very small altitudinal range. Below the cliffs are steep grassy slopes covered with boulders of all sizes, and a little way above the trees which clothe the lower slopes of the mountain is a narrow zone of *Streptocarpus vandeurei* growing on the shady side of the boulders wherever there is shelter and a little soil. The plants occupy about 200 yards of mountain slope, roughly 300 feet of altitude.

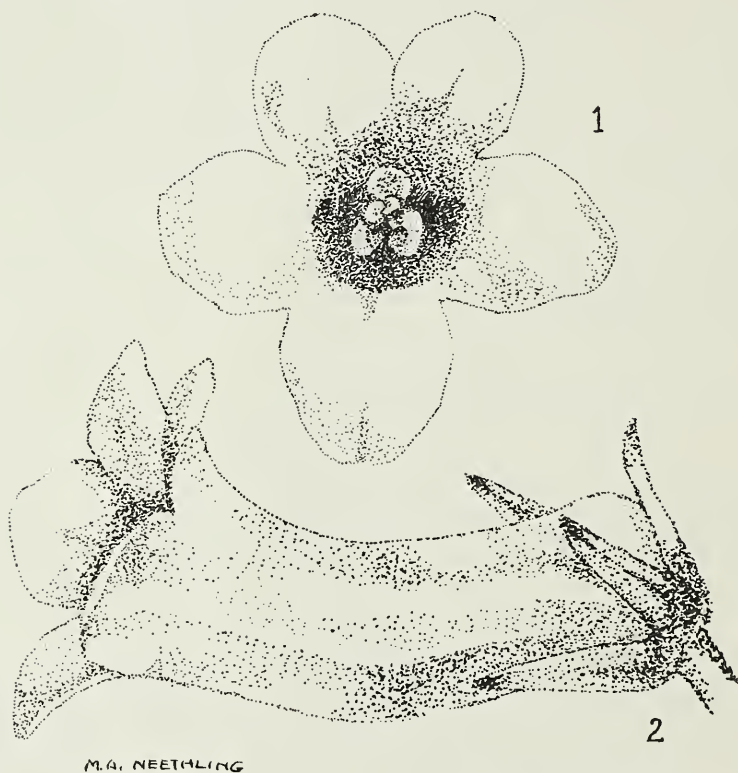


FIG. 1.—*Streptocarpus rimicola*; 1, front view of flower; 2, side view, both  $\times 8$ .

*Streptocarpus rimicola* is often massed together in small irregular patches, but as it blooms sporadically it does not make a show. By about the middle of April the flowering season is over. The flower is tilted upwards and has the anthers only lightly connivent and often separate by the time it is fully open.

The plant is about the same size as *Streptocarpus pumilus*, and closely related. Flower colour is a rather unreliable character in the genus but the specific rank of *Streptocarpus rimicola* appears justified by the other differences which are set out in tabular form at the end of this paper. The hypocotyl is as a rule imperceptible when the plant is growing and the bracketed figure in the table gives the length of the only one of that size seen among the hundreds of plants which were examined. Our only



specimen of *Streptocarpus pumilus* indicates also that it has a more slender capsule than *Streptocarpus rimicola* and a narrower corolla-tube. This last point was confirmed by Mr. B. L. Burtt, the author of *Streptocarpus pumilus*, who kindly reported on a specimen sent to him.

*Streptocarpus pumilus*

1. Flower mauve.
2. Hypocotyl up to 3 cm long.
3. Stamens inserted 6 mm from base of corolla tube.
4. Ovary 2 mm long, style 8 mm long.

*Streptocarpus rimicola*

1. Flower white.
2. Hypocotyl less than 0.5 cm long (rarely up to 1 cm).
3. Stamens inserted 1 mm from base of corolla tube.
4. Ovary 2-2.5 mm long, style 3-3.5 mm long.

R. STORY

### GRAMINEAE

***Digitariella* de Winter**, genus novum, affinis *Digitariae*, sed ita differt: spicula basi in pseudo-callum producta, gluma inferior ab superiore internodio distincto separata, gluma superior et lemma inferius in apicem attenuatum subaristatum sensim producta.

*Annua*, culmis ramosis ascendentibus, nodis villosis, vaginis nodis superantibus, ligula brevi truncata membranacea, laminis linearibus vel lineari-lanceolatis glabris margine crenulatis. *Inflorescentia* 2-3 racemis spiciformibus digitate confertibus. *Spiculae* binae vel solitariae. *Gluma* inferior parva, squamiformis, enervis, longe infra glumam superiorem inserto internodio distincto separata. *Gluma* superior anguste lanceolata 3 mm longa et 0.75 mm lata, sensim in apicem subaristatum 2.5 mm longum producta, 7-nervis cum linea pilorum inter nervos uterque latere costae mediani et ad margines. *Flos inferior* ad lemma reductus. *Lemma* inferius 3 mm longum 0.75 mm latum anguste lanceolatum 5-nerve, haud aristatum. *Flos superior* fertilis, lemmate coriaceo lanceolato-naviculari 2.5 mm longo, breve mucronato, palea coriacea naviculari 2-nervi, lodiculis truncatis, cuneatis enervibus. *Stamina* 3, antheris basi obtuse sagittatis oblongo-ellipticis 0.5-0.6 mm longis, ovario glabro stylis distinctis stigmatibus plumosis. *Caryopsis* libera ambitu oblanceolato-elliptica; embryo 1/3-3/5 longitudinis caryoptidis; hilum subbasale, ellipticum.

Species unica, Africae tropicae austro-orientalis incola.

***Digitariella remotigluma* de Winter**, sp. nov.

*Annual* with ascending branched culms, often rooting at the nodes. *Nodes* sparsely villous. *Leafsheaths* exceeding the nodes, striate, slightly keeled, glabrous. *Ligule* a short membrane. *Collar* glabrous. *Leafblade* linear to linear-lanceolate, glabrous: margin distinctly undulate-crenulate. *Inflorescence* consisting of 2-3 digitately arranged spikelike racemes; racemes 2.5-6 cm long. *Spikelets* usually in pairs, one shortly pedicelled, the other pedicel longer, very occasionally single, abaxial in relation to the axis. *Lower glume* a small nerveless, membranous scale, distant from the upper, clasping the calluslike prolongation of the base of the spikelet. *Upper glume* produced downwards into the callus, connate with it, narrowly lanceolate, gradually produced into an awn-like apex 2-2.5 mm long, 7-nerved, body of the glume about 3 mm long and 0.75 mm wide, nerves on each side of the midnerve approximate, with a line of hairs between them and along the margin; margins somewhat inflexed. *Lower floret* reduced to the lemma. *Lower lemma* narrowly lanceolate, 3 mm long and 0.75 mm wide, acuminate, not awned, 5-nerved, hairy between the lateral nerves, and on the margins.

Upper floret fertile. *Upper lemma* coriaceous, white, lanceolate in outline, boat-shaped, 2.5 mm long and 1 mm wide when spread out, acuminate and shortly mucronate. *Palea* coriaceous, lanceolate in outline, boat-shaped with inflexed margins, 2-nerved. *Lodicules* truncate, cuneate, nerveless. *Stamens* 3; anthers bluntly sagittate at the base, oblong-elliptic in outline, about 0.5–0.6 mm long. *Ovary* glabrous; styles distinct; stigmas plumose, purple. *Caryopsis* tightly enclosed by the lemma and palea but free, oblanceolate-elliptic, whitish, opaque; embryo about 1/3–3/5 the length of the grain; hilum sub-basal, narrowly elliptic, brownish.

SOUTH WEST AFRICA.—Okavango Native Territory: Junction of Mpungu Omuramba and Okavango River between Tondoro and Lupala, soft annual with yellow-green inflorescences on swampy edges of lagoon, 17–12–1955, B. de Winter No. 3978 (PRE, holo; K.M.B, BM, SRGH, Windhoek, iso.); River flats below visitors camp at Runtu, peaty black soil, annual grass growing in moist places on floodplain of river, 22–12–1955, B. de Winter No. 4037. Eastern Caprivi: Mpilila Island, frequent on banks of Zambesi River, Killick and Leistner 3370.

This interesting new genus belongs in the somewhat loosely defined group of the Paniceae sometimes referred to as the *Digitariastrae*. The *Digitariastrae* are characterised as follows: fertile valves thinly chartaceous to cartilaginous with margins hyaline to subhyaline, inflexed but not inrolled, and the position of the spikelet abaxial in relation to the rhachis (upper glume and upper lemma with their surfaces adjacent to the axis).

The closest affinity of *Digitariella* is *Digitaria* as implied by the name. It agrees with *Digitaria* in the loosely paired spikelets, the digitate inflorescence and the approximate lateral nerves of the lower lemma with a line of hair between them. The main differences are the elongated calluslike prolongation of the base of the spikelet and the much attenuated awnlike apices of the lower glume and lemma.

It also agrees in general in the structure of the spikelets with genera such as *Oryzidium* and *Louisiella*. These genera however differ in the adaxial orientation of the spikelet, that is the lower glume and lower lemma are turned towards the axis. Though allied to these genera the affinity is obviously less close than to the members of the *Digitariastrae*.

The basal prolongation of the spikelet of *Digitariella* is not a true callus but is formed by the fusion of the base of the upper glume and rhachilla. This calluslike prolongation strongly reminds one of that found in the South American genus *Chaetium* from which *Digitariella* differs by the orientation of the spikelet and by the minute remote lower glume. In *Chaetium* the callus is formed by the fusion of the rhachilla and the bases of both the glumes. The glumes moreover are large and equal or exceed the spikelets in length. *Chaetium* cannot therefore be regarded as very closely allied to *Digitariella*.

*Eragrostis aristata* de Winter, sp. nov., aff. *E. crassinervi* Hack. sed lemmatibus 3-lobatis, nervo mediano in aristam brevem terminanti, nervis lateralibus in mucrones breves excurrentibus, omnibus nervibus et carinis palearum spinis brevibus hyalinis scaberrimis, gluma superiore 3-nervata.

*Annua* 30–75 cm alta. *Vaginae* internodiis breviores, carinatae, carinis cum glandulis minutis demersis vel crateriformibus. *Ligula* pilis longis hyalinis ciliata. *Lamina* infra galbra, nervis glandulosis scabridis exceptis. *Panicula* ad 30 cm longa 15 cm lata, ramis primariis patentibus, spiculis in ramis secundariis, subdense aggregatis, ramis rhachidibusque scabridis glandulosis. *Spiculae* breve pedicellatae vel subsessiles ca. 6 mm longae 4 mm latae, 5–12-florae, rhachilla persistenti, glumis inequalibus, inferioribus 1-nervatis, superioribus 3-nervatis, frequenter plusminusve 3-lobatis, ad nervos glandulosos, lemmatibus 3-lobatis, nervo mediano in aristam ad 1.5 mm longam excurrenti, nervis lateralibus in mucrones terminantibus, nervis scabridis glandulosis,

paleis carinis scabridis bicarinatis. *Stamina* 3, antheris oblongis 0.5–0.6 mm longis. *Ovarium* glabrum. *Lodiculae* truncatae glabrae. *Caryopsis* oblonga lateraliter leviter compressa.

SOUTH WEST AFRICA.—Omaruru: Namib, Brandberg, annual, along river bed, abundant, *Schweickerdt* 2252 (PRE, holo. K, iso); Brandberg, Hungarob ecke, *Wiss* 1504; Brandberg valley, *Liebenberg* 5019.

*Annual*, 30–75 cm high, with soft erect or geniculate 2–4-nodes culms. *Sheaths* pallid, fairly tight, usually shorter than the internodes, soft, glabrous, distinctly ribbed with small sunken or crateriform glands on the ribs especially below the collar and above the nodes. *Ligule* a fringe of long hyaline bristly hairs; auricles glabrous. *Leafblade* flaccid, glabrous below, with sunken glands on the nerves, scabrid on the nerves on upper surface, usually flat; margin scabrid and with small crateriform glands. *Panicle* exerted when mature, up to 30 cm long and 15 cm wide, primary branches spreading, not whorled, single or opposite, spikelets clustered on the short secondary branchlets, axis and branches ribbed with small crateriform glands on the ribs and scabrid with short hyaline spines. *Spikelets* shortly pedicelled or subsessile on the secondary branchlets, about 6 mm long and 4 mm wide, green to deep purple in colour, 5–12-flowered, breaking up from below, paleas usually persistent on the rhachis. Florets hermaphrodite. *Glumes* unequal to subequal, lower one-nerved, about 1 mm long, upper 3-nerved, often somewhat tri-lobed at apex, 1–1.75 mm long, usually with raised glands on or near the nerves, nerves usually scabrid. *Lemmas* tri-lobed, 2–3.5 mm long, ovate, 3-nerved, midnerve excurrent into an awn up to 1.5 mm long, lateral nerves very shortly awned to mucronate, body of lemma 1.5–2 mm long, strongly keeled along midrib and lateral nerves, scabrid on the nerves and with small raised glands. Palea strongly curved, bi-keeled, keels scabrid with hyaline spines. *Stamens* 3; anthers oblong, 0.5–0.6 mm long, yellow. *Ovary* glabrous; styles free; stigma plumose. *Lodicules* somewhat fleshy, truncate, glabrous. *Caryopsis* oblong, somewhat laterally compressed, pale to deep brown; embryo about 1/2–3/5 the length of the caryopsis; hilum punctiform, basal.

This species has so far only been collected in the vicinity of the Brandberg in South West Africa. It can be expected to occur in the marginal Namib desert right up to the Kunene and possibly a little way beyond into Angola, this area offering similar ecological conditions as those encountered at the Brandberg.

At the first glance *E. aristata* can hardly be recognised as a species of *Eragrostis*, especially when the specimens are not fully mature. It is so obviously related with *E. crassinervis* Hack. however that including it in the same genus as the latter is the only logical way to treat it. *E. crassinervis* has the nerves of the lemmas excurrent into very short mucros, and the awns of *E. aristata* can only be regarded as a further development in this direction. Except for the awned lemmas and 3-nerved upper glume, all the other characteristics agree with those of typical *Eragrostis* species. Three-nerved glumes occur also in *E. bergiana*, *E. truncata* and several other species.

***Eragrostis glandulosipedata*** de Winter, sp. nov., aff. *E. porosae* Nees, sed spiculis majoribus, lemmatibus latoribus et longioribus, pedicello glanduloso differt, necnon affinis *E. omahekensi* de W. sed ab ea lemmatibus brevioribus apice obtusis vel subobtusis recedit.

*Annual* vel *subperennis* 4–100 cm alta. *Culmi* erecti geniculati vel adscendentes, simplices vel ramosi, 2–4 nodosi. *Vaginae* internodiis breviorae, laxae, glabrae vel sparse pilosae, costis glandulosis. *Ligulae* dense ciliatae. *Laminae* flaccidae plerumque planae, glabrae vel sparse pilosae. *Panícula* angusta, plus minusve contracta vel laxa, ramis basi verticillatis apicem versus solitariis vel binis vel ternis plerumque prope basim glandulis immersis. *Spiculae* 6–10-florae, 4–6 mm longae 1.5–2 mm latae, glumis inaequalibus, 1-nervatis acutis, carinis scabridis. *Stamina* 3, antheris 7–10 mm longis. *Caryopsis* oblonga vel late oblonga, subtranslucens.



TRANSVAAL.—Potgietersrus: Roedtan, *Barenbrug* s.n.; Singapore Cash Store, Grass Valley, *de Winter* 2332 (holotype, PRE, isotype, K, BM, M, B, SRGH, EA, BOL); Roedtan, *de Winter* 2224; Roedtan, *de Winter* 2290.

SOUTH WEST AFRICA.—Grootfontein: Awagobib, *Volk* A. 11; Asis, *Volk* A. 60 and 656; Hairabib, *Volk* 504; Auros, *Volk* 616 and 633 (635); Ossa, *Volk* 669; 23.5 m, E. of Otavi on rd. to Grootfontein, *de Winter* 2865; Rietfontein, *Schweickerdt* 2091; Kumkaas, *Kinges* 2797; Auros, Schoenfelder S 563. Okahandja: Teufelsbach, *de Winter* 2694; Okakuja, *Grossarth* s.n.. Tsumeb: Etosha Pan, *de Winter* 2965; Between Tsumeb and Namutoni, *de Winter* 2950. Outjo: Gainatzeb, *Volk* 2670.

KENYA.—Nairobi, Bogdan A.B. 3119 (K).

Annual 4–100 cm high, culms erect, geniculate-ascending or the lower internodes prostrate but not rooting at the nodes, simple or branched, 2–4 noded, internodes hollow, compressible, with a glandular ring just below the nodes, ultimate internode long exerted when mature. *Sheaths* shorter than the internodes, lax, glabrous or hairy with bulbous-based hairs, shiny, glandular on the ribs, especially on the midrib above the node and below the junction of the blade and sheath. *Collar* with a fringe of stiff hyaline hair. *Ligule* a short dense fringe of hair. *Leafblade* linear, flat or somewhat rolled, distinctly veined below, striate above, scaberulous on the striae, glabrous or sparsely hairy, glandular on the midrib or without glands, tapering to a fine point. *Panicle* rather dense or lax, narrowly ovate-oblong to narrowly-oblong, branches whorled at the base, three or two together or single towards the apex, not spreading and somewhat appressed to the rachis; rachis glabrous, often glandular below the lower whorls of branches. *Spikelets* pedicelled, 6–10-flowered, 4–5 mm long and 1.5–2 mm broad, blackish or greenish grey to ashgrey in colour; rachilla tardily disarticulating between the florets. *Florets* awnless, hermaphrodite. *Glumes* 1-nerved, unequal, lanceolate in side view, membranous, acute, scabrid on the keels; lower about 1 mm long, upper about 1.5 mm long. *Lemmas* 1.5–1.7 mm long, broadly elliptic to broadly oblong-ovate, scabridulous especially near the apex, 3-nerved, nerves rather prominent, apex obtuse to subacute. *Palea* as long as lemmas, membranous, hyaline, bi-keeled, scaberulous. *Lodicules* truncate, cuneate, small. *Stamens* 3; anthers 0.7–1 mm long, cultrate, yellow. *Ovary* glabrous; styles free; stigmas 2, plumose. *Caryopsis* oblong to broadly oblong, 0.6–0.9 mm long, pallid to brownish, semitranslucent; embryo half the length of the grain, brownish green; hilum punctiform, basal.

*E. glandulosipedata* has an interesting distribution. It is common in the Grootfontein, Tsumeb and Outjo districts of South West Africa and has also been recorded from the sandy parts of the Springbuck Flats near Roedtan and Grass Valley in the Transvaal. One specimen which undoubtedly also belongs here, was collected by Bogdan at Nairobi, Kenya. Although very interrupted this distribution follows a pattern observed in the case of a number of other species, such as *Tetrapogon tenellus*, *Eragrostis pseudo-sclerantha* and others. Like in many other annual grasses there is a great variation in the size of the individuals of this species. In good years they may reach a height of over 1 m while the author has collected specimens barely reaching 10 cm growing on dry brackish soils at Namutoni. The spikelets however remain characteristic and show little variation even in size.

*Eragrostis kingesii* *de Winter*, sp. nov., aff. *E. procumbenti* Nees, sed ab ea spiculis minoribus, lemmatibus brevioribus, carinis et nervis lateralibus scabridioribus recedit.

Annual, decumbens vel suberecta, parva. Culmi geniculati, 2–4 nodosi, ramosi, glabri. Vaginae glabrae, carinis costisque glanduloso-punctatis. Ligula ciliata. Lamina plana, costa media glanduloso-punctata. Panicula subdense contracta, ramis solitariis el binis vel ternis e basi ramosis, omnibus glandula subbasali, pedicellis apice glandula annulari. Spiculae plumbeae ca 5 mm longae 1–1.5 mm latae, 7–14-florae paleis persistentibus, glumis et lemmatibus post maturitatem deciduis, glumis subaequalibus



quam lemma superius brevioribus, lemmatibus depresso cymbiformibus late ellipticis ambitu oblongis scabridis ad nervos cum glandulis paucibus demersis, paleis quam lemmata brevioribus. *Stamina* 3, antheris globosis 0·3 mm longis. *Caryopsis* late oblongo-elliptica, subtranslucens.

SOUTH WEST AFRICA.—Luederitz: Farm Klein-Aus, decumbent annual around farm houses, 12/5/49, *Kinges* 2236 (holotype, PRE; isotypes, K, M, BM, Windhoek); 8 m. W. of Aus on rd. to Luederitz, *de Winter* and *Gies* 6083.

Decumbent or semi-erect *annual*, only a few cm high. *Culms* geniculate, 2–4-noded, freely branched, internodes often exposed, semi-terete to flattened, distinctly grooved, glabrous, with an annular glandular ring just below the node. *Sheaths* chartaceous, lax and slipping from the culms, glabrous, ribbed, dotted with sunken glands on the ribs and keel, margins subhyaline, membranous. Ligule a fringe of short stiff hairs. *Collar* glabrous, auricles bearded with long stiff hyaline hairs. *Leafblade* up to 2 cm long and 3·0 wide, soft, more or less flat, subglabrous, dotted with sunken glands on the midrib, secondary veins and margin. *Panicle* fairly densely contracted, rigid, erect, 4–5 cm long and 2–2·5 cm wide, branches single or 2–3 together, divided from the base, branchlets and peduncles short, all divisions with a gland below each branching point, and an annular gland on each pedicel. *Spikelets* leadgrey, about 5·0 mm long and 1·1–1·5 mm broad, narrowly lanceolate-cultrate in shape, 7–14-flowered, breaking up from below upwards, paleas persistent, lemmas and glumes falling after maturity. *Glumes* subequal, shorter than the subtended lemma, one-nerved, boat-shaped; lower about three-quarters the length of the upper, lanceolate and acute in profile, keel scabrid occasionally with one or two glands; upper obliquely ovate in profile, keel scabrid. *Lemmas* shallowly boatshaped, broadly elliptic-oblong in dorsal view, 3-nerved, scabrid and with a few sunken glands on the nerves. *Pales* about three-quarters the length of the lemmas, strongly bikeeled, scabrid on the keels, persistent. *Lodicules* truncate, cuneate, 0·2 mm long, fleshy. *Stamens* 3, anthers subglobose, small, 0·3 mm long, yellow. *Ovary* glabrous, styles distinct, stigmas plumose. *Caryopsis* semi-translucent, finely striate, broadly oblong-elliptic in ventral view. *Embryo* half the length of the grain. *Hilum* punctiform, basal.

This species prefers disturbed soil and is usually found on roadsides or around farm houses where it grows as a weed. Like other annual semi-desert species it shoots up after rain, flowers and fruits within a few weeks and dies. It is quite an amazing sight to see these little plants hanging by thin taproots from the side of a bone dry sandbank and still being fresh and green.

This small annual is closely related to *E. procumbens*, which likewise occurs in the dry areas of the Free State, Cape and South West Africa. It differs from the latter as set out in the description and is a smaller plant with less dense inflorescences. *E. procumbens* has as yet not been recorded from the coastal Namib and the areas of distribution therefore do not overlap.

*Eragrostis lamprospicula* *de Winter*, sp. nov., *E. membranaceae* Hack. affinis, sed perenni, cetera spiculis minoribus, inflorescentia minus ramosa ab ea distinguenda.

*Perennis*, erecta. *Culmi* simplices 2–5-nodosi, ad 65 cm alti, infra nodos annulo glanduloso, nodis glabris. *Vaginae* glabrae carinatae, glanduloso-punctatae. *Ligula* brevis ciliata. *Laminae* lineares 5–10 cm longae. *Panicula* laxa, sparse ramosa, ad 12 cm longa 6 cm lata, ramis gracilibus flexuosis, pedicellis 5–12 mm longis apice glandula annulari, spiculis ovato-ellipticis ad anguste oblongis 6–15 mm longis, 6–25-floris, glumis subcoriaceis inaequalibus, uninervatis, lemmatibus coriaceis levibus nitidis latissime ovatis acutis 2–2·5 mm longis 1·75–2 mm latis nervis 3 inconspicuis, palea elliptica 2 mm longa bicarinata truncata membranacea, lodiculis 2 carnosius cuneiformibus 2–3-nervatis, staminibus 3, antheris anguste oblongis 1 mm longis, ovario oblongo stylis 2. *Caryopsis* lateraliter compressa, 1·5 mm longa opaca; embryo dimidio quam granum longiore.



FIG. 2.—*Eragrostis omahekensis* de Winter; a, habit  $\times 1$ ; b, spikelet  $\times 10$ .

TRANSVAAL.—Waterberg: Mosdene Farm near Naboomspruit; bare brack flats, occasional, 65 cm high, *de Winter* 734 (PRE, holo, K, BM, B, M, BOL, SARH, NY, iso.).

SOUTHERN RHODESIA.—Salisbury: Mrs. Kimpton s.n.

Erect and usually somewhat geniculate *perennial*. Culms simple, flattened towards the base, up to 65 cm high, glabrous, 2–5 usually 3-noded; internodes gradually decreasing in length downwards, exerted from the sheaths, with a ring of glands below the nodes; nodes glabrous usually purplish. *Leafsheaths* striate, glabrous, lower ones often tinged with purple, compressed and keeled, usually dotted with glands on the midrib below the collar and above the nodes, glabrous, bearded at the mouth, outer margin hairy with bulbous-based hairs. *Ligule* shortly ciliate. *Collar* inconspicuous, sometimes purplish, glabrous. *Leafblade* linear, up to 10 cm long, smooth and glabrous on lower surface, grooved and scaberulous on the nerves on upper surface. *Inflorescence* rather lax, sparsely branched, elliptic to ovate in outline, up to 12 cm long and 6 cm wide; basal branches subtended by a glandular patch, 2–4 together but not in a true whorl, paired and opposite or single upwards, fine and flexuous, purplish, bearing the spikelets on long fine alternating pedicels; pedicels 5–12 mm long with an annular often conspicuous gland below each spikelet. *Spikelets* ovate-elliptic to narrowly oblong, 6–15 mm long 6–25-flowered, pallid to gunmetal grey in colour. *Glumes* subcoriaceous, unequal, one-nerved; lower lanceolate, more or less 2 mm long, upper ovate-lanceolate, about 2·5 mm long. *Lemmas* coriaceous, shiny, broadly boat-shaped, very broadly ovate in outline, acute, 2–2·5 mm long and 1·75–2 mm wide, 3-nerved, nerves inconspicuous. *Palea* elliptic in outline, 2 mm long, 2-keeled, membranous, margins inflexed, apex truncate. *Lodicules* 2, fleshy, truncate-cuneate, 2–3-nerved. *Stamens* 3; anthers narrowly oblong, about 1 mm long, yellow or purplish. *Ovary* shortly stalked, oblong; styles 2, distinct; stigmas plumose. *Caryopsis* somewhat laterally compressed, 1·5 mm long, obliquely ovate in profile; pericarp swelling and becoming mucilaginous when placed in water; endosperm whitish, quite opaque; embryo half the length of the grain, greenish.

*E. lamprospicula* is only known from two collections, one from Salisbury in Southern Rhodesia and the other from the Waterberg district of the Northern Transvaal. In spite of our scant records it is doubtful whether the species is rare. It is more likely that it has been overlooked due to its superficial similarity to *E. racemosa*.

The specific name is derived from lampro = shiny and spicula = spikelet an illusion to the glossy spikelets of the species.

***Eragrostis omahekensis*** *de Winter*, sp. nov., affinis *E. horizontali* Peter, sed paniculis multo contractis lemmatibus longioribus et acutioribus glumis chartaceis olivaceis differt.

Herba annua caespitosa, culmis erectis vel ascendentibus. *Vagina* glabra vel sparse villosa, glandulosa vel eglandulosa. *Ligula* fimbriata. *Folia* plana, apice setacea. *Panicula* contracta, ramis glandula subbasali, brevibus, spiculis ramis appressis. *Spiculae* angustae oblongae, 5–7 mm longae 1·5 mm latae, 4–9-florae, lemmatibus et glumis deciduis. *Glumae* subequales, 1·5–2 mm longae. *Lemmata* chartacea, oblique lanceolata carinata, acuta, nervis lateralibus prominentibus. *Stamina* 3, antheris oblongis 5 mm longis. *Caryopsis* obovato-oblonga subtranslucens levis.

SOUTH WEST AFRICA.—Gobabis: 12·7 m. W. of Gobabis; *de Winter* 2498 (holotype, PRE, isotype, K, M, BM, Windhoek); 25 m. W. of Gobabis, *de Winter* 2498; near Steinhausen Police Station, *de Winter* 2435; Okasondana, *Schwerdtfeger* 4136; do *Liebenberg* 4560, 4663; Babibabi, *Liebenberg* 4663. Okahandja: *Bradfield* 387; Teufelsbach, *de Winter* 2695; Oukongo, *Dinter* 3364. Otjiwarongo: Quickborn, *Bradfield* 425 and 365.

Erect caespitose annual. Culms straight or somewhat geniculate at the base, single or branched, hollow, 2–4 noded, ultimate internode long exerted. *Leafsheaths* lax, mostly shorter than the nodes, keeled, finely to strongly ribbed, glabrous or sparsely



hairy with bulbous-based long hairs, glanddotted on the keel and ribs with a short transverse fringe of stiff hyaline hairs below the auricles. *Ligule* a dense fringe of short hairs. *Leafblade* usually flat, somewhat flaccid, linear, up to 15 cm long and 0.5 mm broad, tapering to a fine point, glabrous or hairy with long bulbous-based hairs; veins slightly raised below, upper surface striate, scaberulous. *Panicle* usually contracted, very narrowly oblong to narrowly oblong-elliptic, 6–20 cm long 2–5 cm wide; branches short with spikelets densely clustered on them, ascending or more or less appressed to the rhachis; rhachis angular or nearly smooth, branches each with a gland at the base. *Spikelets* very narrowly oblong 5–7 mm long and 1.5 mm broad, dark-grey, 4–9-flowered, rhachilla not disarticulating, lemmas caducous after fruiting, paleas and glumes persistent on the rhachis. *Florets* hermaphrodite. *Glumes* subequal, one-nerved, lanceolate, scaberulous on the keels, 1.5–2 mm long. *Lemmas* chartaceous, obliquely lanceolate in profile, keeled, acute, 3-nerved, nerves prominent. *Lodicules* fleshy, cuneate, truncate, about 0.3 mm long. *Stamens* 3. *Anthers* 0.5 mm long, yellow. *Ovary* glabrous, styles distinct, stigma plumose. *Caryopsis* obovate-oblong, semi-transparent when mature, smooth; embryo 2/5 the length of the grain; hilum basal, punctiform.

This annual grass is almost exclusively found on disturbed places especially along roadsides. On old lands it often forms extensive, practically pure stands. Where present in large quantities it should make an excellent hay.

*E. omahakensis* can fairly easily be confused with *E. horizontalis* but the much more contracted inflorescence, the longer and more pointed lemmas, as well as the firmer grey-green glumes makes it fairly easy to distinguish.

The specific name is derived from the Heroro word "Omahahe" a term used to describe the sandy tree savanah of north-east South West Africa. Up to the present the species has not been recorded outside of this region.

***Eragrostis* × *pseud-obtusa* de Winter, sp. nov. (*E. obtusa* Munro × *E. echinocloidea* Stapf.)**

Planta perennis, caespitosa. *Culmi* 2–3-nodosi, 20–60 cm alti. *Vaginae* striatae, carinatae, carinis saepae glanduloso-punctatis. *Ligula* dense et breviter fimbriata. *Lamina* 5–14 cm longa, 2–3 mm lata, anguste spicata. *Paniculum* plerumque ovato-oblongum, ramis solitariis, angulis glanduloso-punctatis. *Pedicelli* spicularum orbi glanduloso. *Spiculae* late ovato-oblongae, 3–5 mm longae, 2.5–3.5 mm latae, 8–20-florae, olivaceae, lateraliter compressae, rhachilla disarticulata. *Glumae* subaequales, inferiores 1-nervatae superiores 3-nervatae, carinis glanduloso-punctatis. *Lemmata* late et profunde cymbiformia, prominenter 3-nervata. *Palea* 2-carinata, carinis sub media parte anguste alatis. *Stamina* 3, antheris anguste oblongis 0.7–0.8 longis. *Caryopsis* elliptica, 1 mm longa, bis vel ter quam embryo longior. hilo basali punctiformi.

CAPE.—Hopetown: Liebenberg 4150. Kimberley: Moran s.n. (Bolus H. No. 13905); Kameelhoek, Bruckner 21; Kenilworth, Levy s.n. (Galpin Herb. No. 6324); Swan s.n.; Wilman s.n. (N.H. No. 28349). Barkly West: Newlands, Wilman s.n. (Bolus H. No. 25457); Wilman s.n. (N.H. No. 28336); Acocks 140; Brueckner 823. Vryburg: Tiger Kloof, Brueckner 320 (PRE, holo); Armoedsvlakte, Mogg 3960; Mogg 3668; Stent s.n. (H. 21516); Benauidheidsfontein, Marloth 863.

ORANGE FREE STATE.—Fauresmith; C. A. Smith 3879. Kroonstad: Bothaville, Schweickerdt 1113. Jacobsdal: Schweickerdt 1149.

TRANSVAAL.—Christiana: Burrut Davy 11411. Bloemhof: Lombard Nature Reserve, Leistner 91. Wolmaransstad: Sutton 68.

*Cultivated specimens*.—Prinshof Experimental Station: Story 1940; de Winter 710. Johannesburg: ex Prinshof Experimental Station, R. de V. Pienaar s.n. (sp. 16 plant 4 and plant 2).

Dense erect caespitose *perennial*, culms straight, or geniculate at the base, mostly simple, occasionally branched, 2–3-noded, 20–60 cm high, nodes mostly exerted from the sheaths. *Sheaths* pallid often hairy on the margins, striate, keeled, finely gland-



dotted on the keel. *Auricles* softly bearded. *Ligule* a dense line of short hairs. *Leaf-blade* rolled or flat, linear, 5–14 cm long and 2.0–3.0 mm broad when flattened, primary nerves raised below, slightly raised above and scaberulous, tapering to a fine point, midnerve often finely gland-dotted below. *Panicle* lax to dense, more or less ovate-oblong in outline, branches divided once or twice, spikelets densely crowded on the branches, divisions angular, densely gland-dotted on the angles, pedicels of spikelets often with a glandular ring. *Spikelets* broadly oblong-ovate, 8–20-flowered; pallid or grey to gunmetal grey, rather plump, laterally compressed, 3–5 mm long and 2.5–3.5 mm broad; rhachilla readily disarticulating above the glumes and between the florets. *Florets* hermaphrodite falling entire. *Glumes* sub-equal boatshaped, keeled dark metallic green, darker in colour than the glumes, obliquely lanceolate in side view, keels distinctly gland-dotted, apex acute to subacute; lower 1–3-nerved; upper 3-nerved. *Lemmas* broadly and deeply boatshaped, chartaceous, broadly elliptic in back view (not flattened), 3-nerved, nerves green, raised. *Palea* elliptic-oblong, slightly shorter than the lemmas, 2-keeled, keels narrowly winged below, shortly ciliate on the keels and less so on the wings, apex emarginate or more or less truncate to rounded, wings and keels firmer in texture. *Lodicules* small, oblong-cuneate, truncate, 0.5 mm long. *Stamens* 3, anthers 0.7–0.8 mm long, cultrate, yellow. *Caryopsis* elliptic, 1 mm long, brown, slightly dorsally flattened; embryo one-third to half the length of the grain; hilum basal, punctiform.

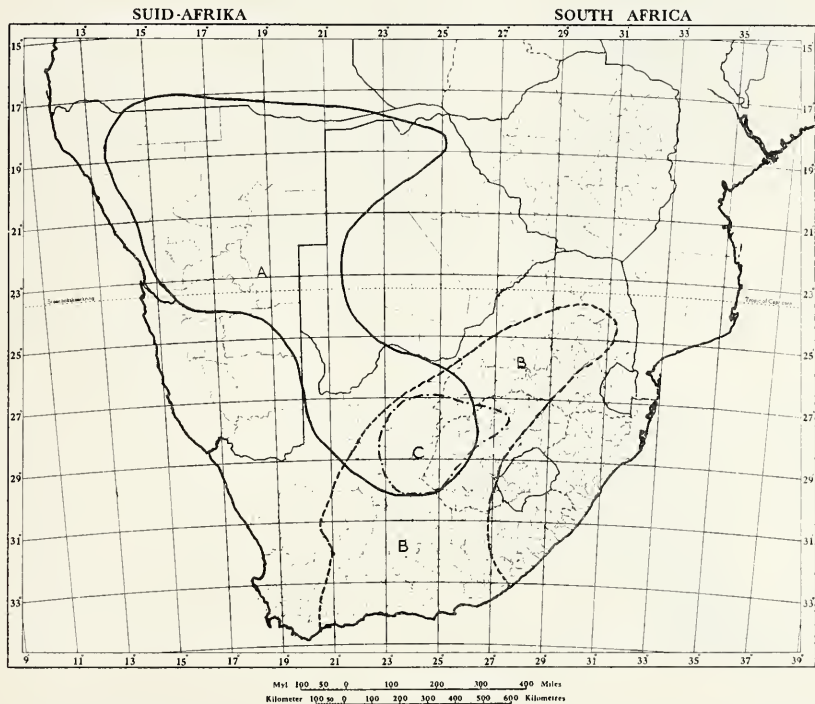


FIG. 3.—Distribution of: A, *Eragrostis echinochloidea*; B, *E. obtusa*; C, *E. × pseud-obtusa* (*E. echinochloidea* × *E. obtusa*).



FIG. 4.—*Eragrostis pseud-obtusa*: a, habit,  $\times 1$ ; b, spikelet,  $\times 10$ ; c, anther,  $\times 10$ ; d, caryopsis,  $\times 10$ ; e, palea of *E. pseud-obtusa*,  $\times 10$ ; palea of *E. obtusa*,  $\times 10$ ; f, palea of *E. echinochloidea*,  $\times 10$ .

*E. pseud-obtusa* occupies an intermediate position between *E. obtusa* and *E. echinochloidea*. The intermediates form a distinct group, situated, when judged on spikelet characters, halfway between the two species. No evidence could be found that these three species naturally grade into one another, in spite of the fact that a large number of specimens of each was available for study. From the rather limited distribution which almost completely covers the area where *E. obtusa* and *E. echinochloidea* overlap (fig. 3), as well as from the completely intermediate character of the spikelet (fig. 4) one can only conclude that the origin of *E. pseud-obtusa* must have been that of a hybrid between the former two species. There is no evidence however that introgressive hybridization has taken place. What the mechanism genetically separating *E. pseud-obtusa* from its parents is, is not clear. It probably is not stabilisation due to doubling of chromosomes, since *E. echinochloidea* and *E. pseud-obtusa* (as sp. aff. *obtusa*) are both reported to have  $2n = 40$  by R. d. V. Pienaar in Grasses and Pastures of South Africa 561 (1955). The genome of *E. obtusa* is still unknown.

The great majority of specimens of *E. pseud-obtusa* have in the past, been referred to *E. obtusa*. This is no doubt due to the fact that *E. pseud-obtusa* more strongly resembles *E. obtusa* in the external appearance of the inflorescence and the spikelets than it does *E. echinochloidea*. When the spikelet is examined the winged palea is immediately evident so that the specimens can easily be distinguished from *E. obtusa*. Due to the very strongly congested branches of the inflorescence, as well as the acuminate glumes of *E. echinochloidea*, *E. pseud-obtusa* cannot easily be confused with it (fig. 4).

The following key will facilitate the identification of the species.

Pales shortly ciliate on the symmetrically rounded keels..... *E. obtusa*.  
Pales with a small flap or wing in the lower half of the keels, upper part of keels scaberulous or shortly ciliate.

Branches of the inflorescence second, very densely contracted with the spikelets densely clustered; glumes distinctly acuminate with the apices diverging and not appressed to the spikelet; flap or wing in the lower half of the keels of the palea usually with a short tooth on the upper part; upper part of keels scaberulous.... *E. echinochloidea*.

Branches of the inflorescence more or less second, fairly strongly contracted or somewhat lax with the spikelets laxly to fairly densely clustered; glumes acute to subacute mostly appressed to the spikelet, flap or wing on the lower half of the keels of the palea without a tooth on the upper part; upper part of keels very shortly ciliate. *E. pseud-obtusa*.

***Eragrostis remotiflora* de Winter, sp. nov., aff. *E. micranthae*, sed ab ea lemmatibus brevioribus haud imbricatis, antheris late ovato-oblongis, caryopsis oblonga dorse canaliculata praecipue differt.**

*Annua* vel *subperennis* 10–55 cm alta. *Panícula* plerumque basi vaginata, demum exserta, 5–20 cm longa 3–14 cm lata ambitu late ovata, laxa, ramis patentibus inferioribus subverticillatis, superioribus solitariis vel binis, rhachide et ramibus primariis saepe glanduloso-punctatis. *Spiculae* solitariae ca 5 mm longae 1 mm latae cinereo-virides vel plumbeae, 4–8-florae, lemmatibus haud vel paucè imbricatis, glumis valde inaequalibus, 1-nervatis, lemmatibus late ovato-oblongis. *Stamina* 3; antherae 0.3–0.4 mm longae. *Caryopsis* oblonga dorsaliter canaliculata.

TRANSVAAL.—Pretoria: in depressis humidis prope Apiesrivier, Jan., 1894, Schlechter 4164 (K); Kaalfontein, Mogg 3741. Bloemhof: Christiana, Burt Davy 12803 and 12795.

ORANGE FREE STATE.—Boshoff: 16 m. W.S.W. of Dealesville, Acocks 14016. Fauresmith: Pole Evans 1583. Bethulie:  $7\frac{1}{2}$  m. N.W. of, Acocks 13521 (PRE, holo. K, M, B, BM, BOL, iso). Bloemfontein: Potts 2423, 2522.

CAPE.—Cradock:  $12\frac{1}{2}$  m. N.N.W. of, Acocks 15764. Tarka: N.N.E. of Tarkastad, Acocks 17953. Middelburg: Acocks 15807. Barkly West: Danielskuil, Esterhuizen 2019 and 1061; Danielskuil *E. Ferrar* 62. Vryburg: Dry Hartz, Mogg 8500; Progress, Mogg 9007; Armoedsvlakte, Mogg 3960.



FIG. 5.—*Eragrostis remotiflora*; a, habit,  $\times 1$ ; b, spikelet,  $\times 10$ ; c, anther,  $\times 30$ ; (Acocks 13521).



*Annual or subperennial*, glabrous, 10–55 cm high, culms erect or sprawling and geniculate, 1–4-noded, slender, rather soft. *Sheaths* pallid, pinkish or purplish, weakly striate, usually exceeding the internodes but lax and stripping from the culms, occasionally shorter, chartaceous especially when withered, keeled, glandular on the keels, margins membranous. *Ligule* a very short dense hairy rim; auricles bearded. *Leafblade* linear, glabrous, flaccid, flat or somewhat rolled, up to 17 cm long and 3 mm wide, midrib prominent below, often dotted with glands, primary nerves prominent below, smooth, upper surface finely striate, scaberulous on the striate, blade tapering to a fine point. *Panicle* usually sheathed at the base by the uppermost sheath, finally exerted, as long as or longer than the rest of the plant,  $5 \times 3$  cm to  $20 \times 14$  cm usually broadly ovate in outline, lax, branches patent or spreading at slightly less than a right angle, subwhorled at the base, single or in two's upwards, axils glabrous or with a few hairs, rhachis and primary branches often dotted with sunken glands especially towards the base of the panicle. *Spikelets* solitary, pedicelled, linear, about 5 mm long and 1 mm wide, greenish-grey to lead-grey, occasionally suffused with purple, 4–8-flowered, lemmas usually not overlapping the florets above on the same side or only shortly overlapping at the base. *Florets* hermaphrodite, lemmas and paleas both falling, but not together leaving the undulating rhachis intact. *Glumes* very unequal, lower one-nerved, lanceolate, 0.5 mm long; upper one-nerved, about 1.5 mm long, lanceolate. *Lemmas* broadly ovate-oblong, sub-membranous, 3-nerved. *Pales* equal to or slightly shorter than the lemma, bifid at the apex. *Lodicules* truncate-cuneate. *Stamens* 3; anthers purple, broadly-oblong, 0.3–0.4 mm long. *Ovary* glabrous, styles free; stigmas plumose. *Caryopsis* oblong, brown, finely longitudinally striate, slightly grooved on the back; embryo two-thirds the length of the grain; hilum punctiform, basal.

*E. remotiflora* resembles *E. pilosa* but can be distinguished from this species by the shorter broader lemmas which do not overlap the base of the lemma directly above it. The lemmas of *E. pilosa* are lanceolate in profile, acute and overlap the base of the lemmas directly above. The grains of *E. remotiflora* are grooved on the back and the embryo is about two-thirds the length of the grain while those of *E. pilosa* taper towards the apex, are rounded on the back and the embryo is about half the length of the grain.

This species is often found growing in association with *E. homomalla* Nees = (*E. hygrophila*. Hubb. and Schweick.) and like the latter is a hygrophilous grass growing in wet or damp soil on the edge of pans and vleis, in the semi-arid areas of the Cape, Transvaal and Orange Free State. It shows a superficial resemblance with *E. homomalla* but can easily be distinguished by the laxer panicle and the smooth nerves of the lemmas which are prominent and gland dotted in the latter.

Its closest relative probably is *E. micrantha* which differs by longer lemmas which overlap each other, the larger cultrate anthers and the long narrow grain. The inflorescence moreover, although lax is much more branched and not nearly as scanty as in *E. remotiflora*.

**Kaokochloa** de Winter, genus nov., *Schmidtiae* aff. sed lemmatibus 2–3-aristatis, duobus nervium lemmatis lateralium (interdum necnon nervo mediano) in aristam planam rectam excurrentibus, apice lemmatis inflexo inter aristas in lobos 2 breves latos nigros membranaceos producto praecipue differt.

*Annual. Culmi* erecti geniculati vel prostrati, ad nodos radicanes. *Vaginae* internodiis breviores. *Ligula* longe ciliata. *Laminae* planae. *Panicula* satis densa, ramis solitariis villosis breve glanduloso-pubescentibus, spiculis 3–6-floris. *Glumae* 9–11-nervatae subaequales late ellipticae velova to-ellipticae. *Flores* hermaphroditi, lemmatibus 9-nervatis late cymbiformis in parte inferiore inter nervos pubescentibus apice inflexo saepe nigro, nervis lateralibus duobus, interdum necnon nervo mediano, in aristam planam rectam excurrentibus, paleis ambitu ellipticis marginibus inflexis carinis fimbriatis. *Lodiculae* 2 cuneatae apice truncatae. *Stamina* 3, antheris lineari-oblongis flavis. *Ovarium* glabrum, stylis 2 liberis, stigmatibus plumosis. *Caryopsis*

obovata, basibus stylorum asymmetricè insertis coronata; embryo 4/5 longitudinis caryoptidis attingens; hilum basale, punctiforme. Species unica: *Kaokochloa nigrirostis* de Winter, spec. nov.

*Kaokochloa* has up to the present only been found in the Northern Kaokoveld, where it inhabits the more western dryer parts of the territory. It often forms large dense stands. The grazing value is unknown but probably is fairly high since the grass is a soft annual.

***Kaokochloa nigrirostis* de Winter, sp. nov.**

*Annual*, 20–60 cm high. *Culms* erect, geniculate or prostrate at the base, and rooting at the nodes, nodes 3–7. *Sheaths* shorter than the internodes, striate, villous with gland-tipped hairs. *Ligule* a fringe of long stiff hyaline bristles. *Auricles* villous. *Leafblade* linear to linear-lanceolate, 5–12 cm long and 5–10 mm wide, tapering to a fine tip, flat, pilose with long slender hairs mixed with shorter gland-tipped hairs. *Panicle* rather dense and contracted, branches single, rhachis and branches grooved, densely villous with a mixture of long villous hairs and shorter gland-tipped hairs. *Spikelets* shortly pedicelled or subsessile and clustered on the rather short branches, sub-globose, about 6 mm wide and 7 mm long, with 3–6 florets. *Florets* hermaphrodite. *Glumes* 9–11-nerved, subequal, equalling the spikelet, broadly boatshaped, 6–7 mm long, broadly elliptic or ovate-elliptic, subacute, villous with long thin hairs mixed with shorter pinshaped glandular hairs. *Lemmas* elliptic in outline, broadly boatshaped, 5 mm long and 3 mm wide, coriaceous, densely hairy in the lower half between the nerves, 9-nerved, one lateral nerve on each side and occasionally the central nerve excurrent in a broad flat straight scabrid awn; lateral awns 4–6 mm long; central awn usually much shorter, 1–3 mm long or not developed; awns usually much shorter or absent in the immature and apical florets; apex of the lemma glabrous, incurved, ending in an awn flanked by two broad short membranous lobes or awn absent and ending in two lobes, lobes usually black in colour. *Palea* elliptic in shape, about 5 mm long and 2 mm wide, thinly coriaceous shallowly concave on the back, keels somewhat thickened, densely fimbriate with short stiff bristles, margins membranous, inflexed, long villous at the base. *Lodicules* 2, somewhat fleshy, wedge-shaped with a more or less truncate apex. *Stamens* 3, anthers linear-oblong, 3–4 mm long, yellow. *Ovary* glabrous, obovate-cuneate in outline, styles 2, stigmas plumose. *Grain* obovate in outline, crowned by the asymmetrically attached base of the style, somewhat convex dorsally and usually flat on the other side; embryo four-fifths the length of the grain, obovate in outline; hilum basal, punctiform, brownish to black.

**SOUTH WEST AFRICA.**—Kaokoveld: 18.5 miles West of Otju (Otjiu), mica schist hillocks and mountain slopes with coarse quartz and limestone gravel, de Winter and Leistner 5679 (PRE, holo; K, BM, M, B, BOL, Windhoek); do. 5679a, cult. at Division of Botany from seed of 5679 (K, BM, M, B, BOL, Windhoek, NY); Warmbad (Warmquelle) near Sesfontein, dolomite slope with quartz intrusions, erect annual forming large almost pure stands, de Winter and Leistner 5848 (K, BM, M, Bolus, NY).

The specific epithet is an allusion to the characteristic black apices of the lemmas.

B. DE WINTER

## HYPOXIDACEAE

***Rhodohypoxis palustris* Killick, sp. nov.** *R. baurii* (Bak.) Nel affinis, sed ita differt: folia conduplicata semi-carnosa rigidula marginibus exceptis glabra flores semper purpureo-rubicundi.

*Cormus* globosus 5–7 mm diam. tunicis apice copiose setosis. *Folia* erecto-arcuata anguste linearia acuminata 2.5–10 cm longa 2–3 mm lata conduplicata semi-carnosa nonnihil rigida flavo-viridia marginibus pilis longis albis alioqui glabra. *Pedicelli* 1–2

simplices erecti graciles 1–6 cm longi sericei. *Perianthium* purpureo-rubicundum tubo 5 mm longo sericeo segmentis oblongis 7–11 mm longis. *Stamina* 6 antheris 2 mm longis. *Ovarium* turbinatum 3 mm longum stigmate trilobato.

CAPE PROVINCE.—Maclear District: seepage on upper eastern slopes of Drakensberg, locally frequent, 8,000 feet, Naude's Nek Pass, *Acocks* 12183; boggy slopes, Naude's Nek, 20·5 miles N.E. of Rhodes, *Marais* 1372.

NATAL.—Bergville District: locally abundant among small stones in shallow stream, 6,050 feet, Cathedral Peak Forest Influences Research Station, *Killick* 956; locally common among small stones in stream in Catchment 1, 6,015 feet, Cathedral Peak Forest Influences Research Station, *Killick* 1602 (PRE, type). Estcourt District: Giants Castle, 8,000 feet, *Symons* 156. Impendhle District: locally abundant in vlei with roots in water, 6,000 feet, "Tillietudlam", *Huntley* 460.

A perennial herb with a globose corm 5–7 mm diam. with fleshy roots and crowned with persistent bristles. *Leaves* radical, erecto-arcuate, narrowly linear, 2·5–10 cm long, 2–3 mm wide, sheathing at base, conduplicate, semi-succulent, somewhat rigid, margins with long white hairs, otherwise glabrous, yellowish green. *Pedicels* 1–2, simple, erect, 1–6 cm long, sericeous. *Perianth* purplish-pink, tube 5 cm long, sericeous; segments oblong, 7–11 mm long, 3–4 mm wide. *Stamens* 6, arranged in two series: anthers 2 mm long. *Ovary* turbinate, 3 mm long; stigma minute, trilobed.

This small plant from the Drakensberg Mountains is an attractive addition to *Rhodohypoxis*, a genus of only two species. For nearly fifty years this plant has passed as *R. baurii* (Bak.) Nel, but it can be distinguished on the following grounds:—

A.—The leaves are conduplicate, semi-succulent, yellowish-green, rather rigid and only hairy on the margins, whereas in *R. baurii* they are more or less flat with a median groove, coriaceous, greyish-green and hairy all over. The leaves of *R. palustris* are narrower than those of typical *R. baurii*, but about equal to those of *R. baurii* var. *millioides*. B.—The flowers are purple-pink, red or crimson. In *R. baurii* they vary from white in forma *platypetala* to red in the typical form. C.—*R. palustris*, as its name indicates, is a vlei or marsh plant, whereas *R. baurii* occupies comparatively dry habitats, for example mountain grassveld and rock outcrops.

D. J. B. KILICK

## LILIACEAE

**Allium rotundum** L. Sp. Pl. ed. 2: 423 (1762).

*A. ampeloprasum* var. B. Gawler in Curt. Bot. Mag. t. 1560 (1813); Thunb. Prod. 65 (1794). *A. dregeanum* Kunth, Enum. 4: 382 (1843); Fl. Cap. 6: 407 (1897). Type: Cape, Queenstown, Stormberg Range *Drège* 8660a (K?).

In the Flora Capensis Baker accepted Kunth's species, *A. dregeanum*, as the only indigenous species found in South Africa. He rejected Regel's conclusion that it should be sunk under an old well-known European species, *A. scorodoprasum* L. (cf. Monogr. All. 42 1875). Recently material of this species was sent to Munich where it was identified as *A. rotundum* L. a native of central and southern Europe and the near East.

**Ornithogalum seineri** (Engl. and Krause) Oberm. comb. nov. *Bulbine seineri* Engl. and Krause in Engl. Bot. Jahrb. 45: 124 (1910). Type: Bechuanaland, Litauani, on grey sand rich in humus between limestone, *Seiner* II, 98 (B, holo.! PRE, photo). *Anthericum seineri* (Engl. and Krause) Poelln. in Fedde, Rep. 53: 136 (1944).



*Ornithogalum filibracteatum* Oberm. in Ann. Transv. Mus. 17: 194 (1937). Type: Transvaal, Letaba: Mbayinbaya, 28 m. south-west of Punda Maria, *Lang* TM 31099 (PRE, holo!). *O. wilmaniae* Leight. in Journ. S.A. Bot. 11: 168 (1945). Type: South West Africa, Gobabis district, Sandfontein, *Wilman* in BOL 15280 (holo) in KMG 1599 (iso).

*Urginea langii* Brem. in Ann. Transv. Mus. 15: 237 (1933). Type: Transvaal, Pietersburg: Brak Rivier vlei, *Bremekamp* and *Schweickerdt* 25 (PRE, holo!).

This *Ornithogalum*, like many others, may look deceptively different in the herbarium because of several factors. In a wet season the uppermost flowers develop, giving the raceme a cylindrical appearance but in dry conditions these remain sterile thus giving it the pyramidal shape so typical of *Urginea langii*. The type of *O. filibracteatum* shows a very young inflorescence with short pedicels and long filiform bracts protruding far beyond the buds. As the pedicels lengthen only during anthesis none had attained their maximum length when the specimen was preserved. The long filiform bracts giving the young raceme a brushlike appearance, seem characteristic but it was seen in other species, for instance *O. pulchrum* Schinz, that they may be long or short in specimens found in the same area; moreover the thin upper part of the bract often dries up at an early stage.

Bremekamp had classified this species as an *Urginea* because of the flat round seeds. The seed of *Urginea* however is very different; it is long, narrow-elliptic, with a narrow, often winged membrane around its perimeter. There are moreover some other very good characters which typify the genus *Urginea* and which are absent in our species; (a) the inflorescence and the often hysteranthous leaves evolve from different buds whilst in *Ornithogalum* the central raceme terminates the leafy rosette; (b) the lowest or central bracts are spurred; (c) the bulb consists of loose scales. Dr. J. M. J. de Wet who studied the chromosome pattern of *Ornithogalum wilmaniae* Leight. (cf. Cytologia 22: 145-159, 1957) found that it possessed large chromosomes with the number  $n = 10$  and they showed affinity to other South African species of *Ornithogalum*. Dr. de Wet suggested that it might form a stepping stone between *Urginea* and *Ornithogalum*.

The type of *Bulbine seineri* Engl. and Krause has no underground parts preserved but Seiner described it as a bulbous plant. The filaments are described as "tenua", and are not bearded.

The species is found in the warmer parts of the Kruger National Park, in the Transvaal Bushveld, the Kalahari region and the northern districts of South West Africa.

***Ornithogalum pulchrum* Schinz.** In her revision of the South African species of *Ornithogalum* [J.S.A. Bot. X: 169 (1944)], Leighton mentions that *O. pulchrum* Schinz [Verh. Bot. Ver. Prov. Brandenb. 31: 221 (1890)] might be the same as *O. wilmaniae* but as she had not seen the type and as it had no leaves, she hesitated to associate her species with *O. pulchrum*. The Director of the Zürich herbarium kindly sent us the Schinz type on loan. *O. pulchrum* is a tall plant, not identical with *O. seineri* (*O. wilmaniae*) and the following specimens at PRE match the type.

SOUTH WEST AFRICA.—Grootfontein: Tsumeb, *Naegelsbach* 9. Omaruru: Spitzkopje, *Boss* TM 36006. Kaokoveld: Kaoko-Otavi, *de Winter and Leistner* 5573. Okavango Native Territory: near Okavango River at Mupini, *de Winter and Marais* 4497 (with shorter bracts).

SOUTHERN RHODESIA.—Sabi-Lundi River Junction, *Wild* 3490.

Baker in the Flora of Tropical Africa 7: 545 (1898) placed *O. pulchrum* under *O. longibracteatum* Jacq. This species comes from the eastern Cape and *O. caudatum* Jacq. is a synonym. The length of the bracts varies and is unimportant.



Some differences between *O. pulchrum*, *O. longibracteatum* and *O. seineri* are as follows

<i>O. pulchrum</i>	<i>O. seineri</i>	<i>O. caudatum</i>
Tall plants up to 2½ m.	Plants up to 50 cm.	Plants up to 1 m.
Leaves up to 70 cm long.	Leaves up to 30 cm long.	Leaves up to 70 cm long.
Raceme cylindrical bearing ca 300 flowers; usually with sterile apical flowers.	Raceme usually pyramidal bearing ca 100 flowers; usually with sterile apical flowers.	Raceme cylindrical bearing ca 80 flowers; no sterile apical flowers seen.
Scape 200 cm high, straight.	Scape ca 20 cm high arcuate.	Scape ca 80 cm, straight.
Bracts up to 7 cm long (occasionally shorter).	Bracts 2 cm long (occasionally longer).	Bracts variable in length, 2-4 cm long.
Pedicels slender, up to 2.5 cm in fruit.	Pedicels sturdy, up to 6 cm in fruit.	Pedicels slender up to 1.2 cm in fruit.
Perianth segments lanceolate, 20 mm long.	Perianth segments lanceolate, 17 mm long.	Perianth segments ovate, 10 mm long.
Filaments ovate, attenuated to the apex.	Filaments linear-lanceolate, acute near the apex.	Filaments ovate, attenuated to the apex.
Ovary oblong, 3-lobed.	Ovary oblong, 3-lobed.	Ovary rounded.
Capsule 3-angled.	Capsule 3-angled.	Capsule rounded.
Seeds discoid, elliptic, 8 mm long.	Seeds discoid, round, 11 mm in diam.	Seeds angled, narrow-oblong in outline.
Solitary plants.	Gregarious plants.	Solitary or in clumps, producing bulbils
Sweet smelling.	Faintly scented.	Said to be scentless.
Northern South West Africa, Southern Rhodesia.	Northern Transvaal, Kalahari Region, central and northern South West Africa.	Eastern Cape, Natal.
Usually in rocky crevices.	Sandy flats.	In shady kloofs and grassy valleys.

The type of *Urginea dimorphantha* Bak. [Bull. Herb. Boiss. 2nd Ser. No. 8, p. 663 (1903)] from South West Africa, Ovamboland, Ondonga, *Rautanen* (Z. holo PRE, photo), kindly sent on loan to us by the Director of the Zürich Herbarium, proved to be a synonym of *Ornithogalum pulchrum* Schinz. Baker had placed this specimen under *Urginea* as the seeds are discoid.

A. AMELIA OBERMEYER

## MALVACEAE

*Abutilon flanaganii* A. Meeuse, sp. nov., *A. pseudocleistogamo* Hochr. affinis, sed inter alia floribus majoribus, petiolis longioribus differt.

Frutex ramosus 25-40 cm altus verisimiliter perennis. *Caules* teretes cinereo-velutini. *Folia* late ovato-cordata, interdum indistincte 3-lobata, plus minusve acuminata, obtusa minutissime mucronata, irregulariter crenata vel sinuata vel subserrata interdum subintegra, supra intense viridia minutissime stellato-velutina, subtus cinerea, stellato-velutina, nervis subtus prominentibus; lamina 2-5 cm longa 1.5-4 cm lata, petiolis gracilibus cinereo-velutinis interdum parce pilosis 2-5 cm longis, stipulis subulatis 4-6 mm longis. *Pedicelli* graciles axillares, solitarii, cinereo-velutini, ad 60 m longi apicem versus articulati. *Calyx* cinereo-velutinus, 5-fidus, tubo cupuliformi c. 3 mm longo, lobis lanceolatis vel lanceolato-deltoides carinatis aristato-apiculatis c. 7 mm longis. *Petala* flava subglabra basi dense ciliata c. 20 mm longa. *Columna staminialis* apice stellato-hirsuta. *Infructescentia* discoidea, 4-5 mm alta, c. 9 mm diam., mericarpiis 9-13 monospermis subquadratis vel minute mucronatis stellato-hirsutulis c. 4 mm longis 5 mm latis. *Semen* minutissime punctato-verruculosum c. 2 × 1.5 mm.

CAPE PROVINCE.—Komgha: near Komgha, *Flanagan* 340 (PRE, holo., NBG, iso.).

A low much-branched shrub 25–40 cm tall apparently perennial, covered on the vegetative parts, pedicels and calyces with a short smooth velvety tomentum which is canescent except on the upper leaf-surface, in addition longer more or less patent pilose hairs are sometimes found at the very base of the lower leaf-surface, stems, on the petioles and on the pedicels, more often in tufts at the apex of the petiole. *Stems* terete, slender but firm to wiry, glabrescent, the bark ultimately somewhat wrinkled. *Leaves* broadly ovate-cordate, sometimes very faintly 3-lobed, shortly acuminate obtuse and generally minutely mucronate, irregularly crenate, repand or serrate to subentire, 2–5 cm long and 1.5–4 cm broad, dark green (drying dark olive brown) and very shortly velvety above, the paler lower surface with fine prominent main veins; petioles slender, 2–5 cm long; stipules subulate, 4–6 mm long. *Flowers* solitary, axillary; pedicels slender, up to 5 cm long articulated in upper 10 mm. *Calyx* deeply dissected; tube cupuliform, about 3 mm long, lobes lanceolate to triangular-lanceolate, carinate by the prominent midrib, apiculate-aristate, about 7 mm long. *Petals* yellow, glabrous or nearly so except the densely ciliate narrow base. *Staminal column* stellate-hirsute at the apex of the conical dilated basal portion. *Fruit* discoid, 4–5 mm high and about 9 mm in diam., of 9–13 subquadrate 1-seeded, 3–4 mm high and 5 mm broad mericarps which are horizontally truncate at the upper edge forming an acute or somewhat mucronate angle of about 90° with the dorsal side, are rounded at the basal dorsal angle and have a subterminal ventral tooth which is almost level with the apical edge. *Seed* finely punctate-verruculose, about  $2 \times 1.5$  mm.

This species differs from all other African species in the small mericarps which are broader than they are high. The only other species with similar mericarps is *A. pseudocleistogamum*, a Madagascan species from which it differs in several respects, especially in the much larger flowers and considerably longer petioles. In habit it is not unlike *A. fruticosum* and *A. sonneratianum*, but its small 1-seeded mericarps distinguish it at once. *A. flanaganii* is named after Henry G. Flanagan, who contributed so much to our knowledge of the flora of the Eastern Cape Province, mainly of the Komgha and surrounding districts, through his extensive collections of neatly prepared herbarium specimens of which the main set is in the National Herbarium, Pretoria.

*A. flanaganii* is apparently a very local and rare species, because only the single cited gathering was found among all the material from the South African and some European herbaria.

**A. galpinii** *A. Meeuse*, sp. nov., *A. grantii* *A. Meeuse* (*A. indico* sensu Harv., non Don)\* et *A. piloso-cinereo* *A. Meeuse* (vide infra) arcte affinis, sed mericarpis minoribus, foliis majoribus caudato-acuminatis praecipue differt.

Suffrutex ramosus c. 75 cm altus, breviter stellato-tomentosus vel subvelutinus in partibus junioribus sparse glandulosus. *Caules* interdum breviter stellato-pilosi. *Folia* late ovato-cordata vel cordato-suborbicularia, 3–16 cm longa 2–12 cm lata, abrupte acuminato-caudata, subtriloba, margine irregulariter dentata, crenata vel subserrata, supra intense viridia in siccitate atrobrunnea dense strigoso-subvelutina demum glabrescentia et scabrida, subtus pallidiora subarachnoideo-tomentosa, petiolis laminis subaequilongis, stipulis lineari-lanceolatis ad 6 mm longis. *Flores* solitarii, axillares, pedicellis gracilibus ad 5 cm sub fructu ad 7 cm longis. *Calyx* cupuliformis, infra medium lobatus, molliter stellato-tomentosus 9–12 mm longis, lobis ovatis vel ovato-deltoides apiculato-caudatis, apiculo subulati-filiformi ad 2.5 mm longo. *Petala* lutea vel dilute ochracea, glabra, basi ciliata, 11–13 mm longa. *Columna staminalis* basin versus subsparse stellato-hirsutula. *Infructescentia* breviter cylindrato-semiglobosa interdum subcampanulata, apice truncato-concava, c. 10 mm longa 12–14 mm diam. *Mericarpia* c. 16, 3-sperma, oblique truncata, dorso et apicem versus subsparse molli-terque stellato-pubescentia 8–10 mm longa 5–6 mm lata, acuta vel mucronata. *Semina*  $2.5 \times 2$  mm, atrobrunnea, minute verrucoso-punctata.

\* Vide Meeuse in Fl. Zamb. part 2 (1960), in press.

TRANSVAAL.—Barborton: Barborton, Umvoti Creek, *Galpin* 767 (PRE, holo.!, GRA, iso.!). Valley near Edwin Bray Battery, *Galpin* 1197 (PRE); Barborton without precise locality, *Williams* s.n. = TRV 7671 (PRE).

SWAZILAND.—Bremersdorp, *P. Hutchinson* 8 (PRE).

PORTUGUESE EAST AFRICA.—Lourenco Marques Distr.: Goba, Lebombo escarpment, *Fidalgo de Carvalho* 257 (LM, PRE).

NATAL.—Lower Tugela: Tugela Valley below Sans Souci, *Edwards* 1688 (NU, PRE).

Suffrutex attaining a height of at least 75 cm, much branched in upper portion, covered with a short stellate-tomentose to velvety pubescence on vegetative parts, pedicels and calyces; the youngest parts, apical portions of pedicels and calyx-tube sometimes also somewhat glandular. *Stems* slender, wiry, terete, rather soon woody, glabrescent, the pubescence sometimes somewhat pilose. *Leaves* broadly ovate-suborbicular with cordate base and a triangular long-attenuate to acuminate or caudate apex, often abruptly narrowed into the acumen from a broad base which gives the blade a low, but distinct, 3-lobed appearance; the tip of the acumen subobtusely to acute, minutely mucronate; the basal sinus more or less triangular, usually rather deep; basal lobes rounded, the small lateral lobes, if present, more or less triangular, obtuse or acute; the margin irregularly dentate, serrate or crenate, generally shallowly so to subtire but the apical portion of the acumen always entire; upper surface deep green often drying a dark olive-brown, when young densely velvety strigose, later sparsely stellate-strigose, glabrescent and turning slightly scabrid, lower surface distinctly paler, dirty greyish-yellow, sometimes faintly glaucous, at first very densely stellate-tomentose, later with a cob-webby stellate tomentum; petioles terete, in young leaves tomentose, later usually with short spreading to deflexed somewhat stiff stellate hairs especially near the apex, a little shorter to a little longer than the 3–16 cm long and 2–12 cm broad blades; stipules linear-lanceolate, up to 6 mm long. *Flowers* solitary, axillary on main stems and/or on short lateral shoots; pedicels slender, terete, in flower up to about 5 cm, in fruit up to about 7 cm long, articulated near the apex. *Calyx* cupuliform, lobed to a little beyond the middle, 9–12 mm long, with ovate to ovate-triangular acute lobes each terminating in a subulate to filiform, up to 2.5 mm long, apiculus. *Corolla* described as orange-yellow and buff; petals 11–13 mm long, glabrous or nearly so, the narrowed base ciliate. *Staminal column* rather coarsely and sparsely beset with many-rayed stellate-hairs in basal, conical portion. *Fruit* shortly subcylindric to semi-globose or slightly campanulate about 10 mm high, 12–15 mm in diam., truncate-concave at the apex; mericarps about 16, 3-seeded, 8–10 mm long measured along the back and 5–6 mm broad; much compressed, papery, softly and rather sparsely stellate-pubescent along the back and apical portion; the back straight or somewhat bulging in lower half, then inwardly rounded into the truncate base, the apical edge convex or nearly straight, slanting upwards towards the shortly toothed mucronate dorsal apical angle, ventral tooth small. *Seeds* 2.5 × 2 mm, dark brown, finely verruculose-punctate with minute, usually orange-brown protuberances.

The much compressed relatively broad, and papery mericarps indicate that this species is related to *A. grantii* (= *A. indicum* sensu Harv. in Fl. Cap., non Don) and *A. piloso-cinereum*, and consequently to *A. sonneratianum*, but the mericarps are very much smaller, the leaves larger and caudate-acuminate and the calyx-lobes have a subulate-filiform up to 2.5 cm long apiculus.

This species remained unrecognised for a long time although it was collected by Galpin as early as 1896. Burt Davy, in his Manual Fl. Transv. 2: 275 (1932), refers *Galpin* 767 to *A. mauritanium* (Jacq.) Medic. to which it is not remotely related, and *Galpin* 1197 to "*A. indicum*" (= *A. grandiflorum* Don) which it does not resemble.

The species under discussion seems to be mainly restricted to the Barborton area and the Lebombo range. It is found in light shade on lower mountain slopes between 600–1,200 m altitude.



**A. piloso-cinereum** *A. Meeuse*, spec. nov., *A. grantii* *A. Meeuse* (= *A. indico* sensu Harv. non Don) arcte affinis, sed plantis canescentibus ceteris caulibus petiolis pedicellisque pilis longis patentibus subsparsis obtectis praecipue differt.

Suffrutex probabiliter annuus paucè ramosus ad 1·50 m altus. *Caulis* stellato-tomentosus vel subvelutini, pilis longis patentibus subsparsis pilosis. *Folia* late ovato-cordata vel suborbiculari-cordata ad triangulato-cordata, interdum plus minusve 3-lobata, apice acuminata vel attenuata, margine subregulariter serrata vel crenato-de tata, supra saturate viridia minute adpresse stellato-pubescentia demum glabrescentia, subtus molliter velutinosa albido-canescens conspicue prominenter venosa, 2–7 cm interdum ad 15 cm longa, 1·3–5 cm interdum ad 10 cm lata, petiolis laminis subaequilongis tomentosis vel subvelutinis pilis patentibus sparse pilosis. *Flores* axillares solitarii, pedicellis tomentosis vel subvelutinis pilis patentibus sparse pilosis. *Calyx* campanulato-cupuliformis, infra medium lobatus, 9–12 mm longus, dense velutinosus, lobis ovato-lanceolatis vel oblongo-lanceolatis acutis vel acuminatis vel breviter apiculatis. *Petala* flava 14–18 mm longa, glabra. *Infructus* subcylindrato-semiglobosa, 10–12 mm longa, 15–20 mm diam. *Merica* 10–18, 3-sperma, 10–12 mm longa, 6–7 mm lata, apice oblique subtruncata angulo dorsali dentato vel rostrato, dorso et apicem versus stellato-pubescentia vel tomentosa. *Semina* c. 2 × 2 mm, minute verruculosa.

TRANSVAAL.—Pietersburg: Chunies Poort Police Station, *Meeuse* 10352 (PRE, rolo.!, BM, BOL, EA, K, L, LD, M, SRGH, isos.!). Potgietersrust: near Potgietersrust, *Maguire* 1499 (NBG). Waterberg: farm Mosdene near Naboomspruit, *Galpin* M 23. Brits: Hartebeespoort, *Lotsy* and *Goddijn* 348 (L); Hekpoort, *J. Phillips* 519. Pretoria: 18 m N.E. of Pretoria near Roodeplaat, *Repton* 4309; about 12 miles from Pretoria on road to Zeekoegat (Roodeplaat), *Repton* 979; Pretoria North, *Crawley* PRE no. 5181; Pretoria, Arcadia, *Leendertz* 463 (L, PRE); Pretoria, Curtis' Hill, *Pole Evans* 75; Pretoria, *Esterhuysen* h. no. 26321 (BOL); Fountains Valley, *Repton* 223; Hennopsrivier, *Bremekamp* TRV no. 29048. Krugersdorp: Waterval Kloof, *Mogg* 20353 (J, PRE). Vereeniging: Kaalplaats, *Mogg* 10222. Klerksdorp: Klerksdorp, "Convent" 67 (GRA). Rustenburg: Zwartuggens Ridge, *Sutton* 827, 849; Witkransloof, *Rose Innes* 41. Marico: Zeerust, *Leendertz* h. no. 11312.

ORANGE FREE STATE.—Kroonstad: Kroonstad, *Pont* 681; Fauresmith: Fauresmith, *Verdoorn* 946, 1180, *Verdoorn* in herb. Henrici 2396, *Smith* 3980, *Henrici* 2008, *Leistner* 1104 (KMG, PRE). Bloemfontein: Bloemfontein, *Bolus* 11047 (BOL), *Wasserfall* 842 (NBG); Naval Hill, *Potts* 8022; Glen. *Potgieter* 60. District unknown: "Sepani", *Brierley* 21 (BM).

CAPE PROVINCE.—Aliwal North: Ruigtefontein, *Theron* A1795 (NH, PRE).

(All specimens, if not otherwise indicated, in PRE).

A low suffrutex or soft shrub usually scantily branched (from the base or only higher up), probably annual, covered on stems, petioles and pedicels with a short dense tomentose or velutinous pubescence which is usually greyish or whitish and interspersed with long thin patent hairs. *Stems* terete, ultimately somewhat woody with a rather large pith and a thin somewhat wrinkled grooved bark. *Leaves* in outline suborbicular cordate or broadly ovate-cordate to triangular-cordate, sometimes faintly 3-lobed by projecting lateral lobules near the middle of the blade, acuminate or gradually attenuate at the apex, rather regularly crenate-dentate to serrate but usually only shallowly so, 2–7 cm, occasionally up to 15 cm long and 1·3–5(–10) cm broad; upper surface dark green, minutely adpressed-stellate pubescent, glabrescent, the lower surface canescent, softly tomentose to velutinous with prominent nervation; petioles about as long as the corresponding blades; stipules subulate, tomentose or velutinous. *Flowers* axillary, solitary; pedicels in flower up to 7 cm long, in fruit up to 9 cm. *Calyx* cupuli-



form-campanulate, densely velutinous and the tube sometimes with additional patent hairs, greyish, grey-green or canescent, deeply lobed, 9–12 mm long; the lobes oblong-lanceolate to lanceolate, acute, shortly acuminate and/or shortly apiculate. *Petals* yellow, 14–18 mm long, glabrous. *Staminal column* stellate-pubescent. *Fruit* semi-globose-subcylindric, 10–12 mm long and 15–20 cm in diam. *Mericarps* 10–18, 3-seeded, 10–12 mm  $\times$  6–7 mm, the apical edge somewhat convex, slanting upwards and outwards and meeting the dorsal side at an acute angle, produced into a tooth or subulate up to 2 mm long awn; the ventral tooth small, the keel on the back and the apical edge with a row of many-rayed stellate hairs flanked on either side by a zone which is rather sparsely tomentose or stellate-pubescent with adpressed, smaller and fewer-rayed stellate hairs. *Seeds* about  $\times$  2 mm, minutely verruculose-punctate.

This plant is obviously closely related to *A. grantii*, a coastal species, which it resembles very much in the morphology of the mericarps. It differs in a number of points such as in the leaf-shape which is usually abruptly acuminate in *A. grantii* from a broad basal portion and hence more distinctly 3-lobed, in the leaf-margin which is usually more entire in *A. grantii* and in the pubescence of the lower leaf-surface which is very short and smoothly velutinous in *A. grantii*, more loosely stellate-velutinous in *A. piloso-cinereum*, but mainly in the presence of long patent hairs which are never numerous in *A. grantii* (and restricted to the very young parts and the apices of the petioles), conspicuous in *A. piloso-cinereum*, and in the colour of the stems which are not canescent and often dark purple in *A. grantii*, canescent in the other species and later brownish or greyish but never dark.

*A. grantii* is a perennial and *A. piloso-cinereum* apparently an annual, but this difference is not always evident from herbarium specimens. *A. piloso-cinereum* is by no means rare; the numerous cited specimens also indicate that it is wide-spread. The specimens were lying in the herbaria usually under *A. sonnerati* or "*A. indicum*".

It is a plant of rocky slopes in areas with a fairly low annual rainfall, found at altitudes between 900 and 1,200 m and its ecology is, therefore, quite different from that of *A. grantii* which is a plant of coastal bush and lowland forests below 300 m altitude, not usually found on rocky soil but generally on alluvial deposits.

***Pavonia transvaalensis* (Ulbr.) A. Meeuse**, stat. nov.—*P. schumanniana* Gürke var. *transvaalensis* Ulbr. in Engl. Bot. Jahrb. 57: 178 (1921). Type of variety: Transvaal, Magalakwin River, Schlechter 4270 (B, holo.†, PRE, iso.!).

*P. schumanniana* Gürke var. *parviflora* Schinz in Bull. Herb. Boiss. 2me sér. 3: 829 (1903). Syntypes of variety: Transvaal, Pretoria Distr., Rehmann 4185, 4365, 4938; Potgietersrust Distr., Rehmann 5492 (all in Z).

*P. commutata* Conr. in Kew Bull. 1908: 220 (1908); Schinz in Vtljschr. Naturf. Ges. Zürich 68: 428 (1923); Burt Davy, Man. Flow. Pl. Transv. 2: 278 (1932), non Garcke. Type: Transvaal, Pretoria, Conrath 42 (K, holo.!).

The status and synonymy of *Pavonia commutata* Conr. in relation to some other species of *Pavonia*, especially *P. clathrata* Mast. (= *P. schumanniana* Gürke), was cleared up and discussed by Schinz (1923), but this author overlooked the fact that the epithet *commutata* was pre-occupied in *Pavonia*. The epithet selected from the two varietal names cited above is not the oldest, but the epithet "*parviflora*" is inappropriate, whereas "*transvaalensis*" is very suitable for this species which has not been recorded from outside the Transvaal.

A. MEEUSE

## PLUMBAGINACEAE

## LIMONIUM

In Flora Capensis 4, 2: 419 (1906) Wright retained the generic name *Statice* for the species from southern Africa. Sprague in Journ. Bot. 62: 267 (1924) reaffirmed that *Limonium* should be restored to generic status and gave a fairly comprehensive index to relevant literature. The result of the restoration of *Limonium*, excludes *Statice* from the indigenous flora of southern Africa. However, for convenience of discussion, existing names will be used in the following notes.

The distribution of *Limonium* species is generally accepted as being predominantly maritime. It is interesting to note, therefore, that one variable species, *L. dregeanum* (Presl.) O.K., has a wide distribution inland and extends to relatively high altitudes in the central Karoo. On the other hand no species occurs on our coast further east than about Kentani in the Cape Province.

In working on the genus for the Flora of Southern Africa the usual crop of problems had to be faced and I wish to thank very sincerely the Curators and Directors of the several institutions which supplied material for study. These include K, UPSV, S, SBT, G, M, BOL, GRA, STE, SAM and NBG.

As regards the generic description of *Limonium*, in none of the southern African herbarium material dissected could I distinguish a measurable corolla tube and all petals appeared to be free to the base and to have the filaments of the stamens attached slightly above the base. The anthers of all material dissected were divided up to the point of attachment of the filament and in no case was this appreciably less than half the length of the anther. The ovary was invariably five-angled with five free styles, one from the margin of each angle at the top.

An early problem was the identity of *Statice perigrina* Bergius, Descript. Pl. Cap. 80 (1767), which has priority of publication over all other names, including *S. purpurata* L. in his Mantissa, also published in 1767 (see Sprague in Kew Bull. 1929: 88). Boissier in DC. Prod. 12: 667 (1848) regarded *S. perigrina* Berg. as a synonym of *S. rosea* Smith (1819) and Wright F.C. l.c. 420, followed suit but they chose to retain the epithet *rosea*. Smith, however, when describing his *S. rosea* place, *S. perigrina* doubtfully under *S. purpurata* L. thus indicating that he excluded it from his *S. rosea*. Photographs and notes from Stockholm prove that *S. perigrina* does not agree specifically with *S. purpurata*. One of the features of *S. purpurata* is the smoothness of the leaves, whereas those of *S. perigrina* are in fact roughish on both surfaces, although Bergius described them as glabrous on the upper surface and scabrid on the lower. My research supports the taxonomy of Boissier and Wright but the epithet *perigrina* must be restored to priority.

The position is complicated further by the presence in Malmesbury district, with the above-mentioned species, of *S. longifolia* Thunb. (1794), which was regarded by Boissier (1848) as a variety of *S. purpurata* L. Unlike the others, *S. longifolia* is constant in having dense adpressed hairs almost to the tips of the calyx ribs. A specimen, Compton 19361, from Bellville Division, nearest *S. purpurata* L. has a few hairs near the tips of the calyx ribs and another, Acocks 19785, from Clanwilliam, regarded by me as a form of *S. perigrina* also has a few hairs towards the tips of the calyx ribs. In this feature they indicate some relationship with *S. longifolia*, which has a wide range of distribution along the Cape western districts.

With *S. longifolia* Thunb. in the picture, it seems that *S. purpurata* falls somewhere between the more common and more widely spread species *S. perigrina*, a leafy shrub, and *S. longifolia* a more tufted subacaulescent perennial.

It could be suggested that *S. purpurata* arose by hybridisation between *S. longifolia* and *S. perigrina* but at this stage proof is lacking.

A broad view is taken of the variation within the species *S. longifolia* Thunb. which results in the loss of specific status of *L. fergusonae* Bolus. The distribution range is from the coastal districts of the west via the mountainous region of Worcester and Robertson to Riversdale on the south coast and omitting the intervening coastal area of the Peninsula to Swellendam.

The type specimen of *L. amoenum* (C. H. Wright) R. A. Dyer, collected at Tows River by Bolus (BOL 1080) has not been matched exactly by other collections from neighbouring districts but several are regarded as specifically equal. A feature of the main specimen on the type sheet is the straight scape with up to 15 sessile spikelets. The scapes in most specimens are more branched and somewhat flexuous and with only about five spikelets. The type was obviously grazed short before it produced the new inflorescences and it is assumed that this caused the variation in habit. This view is supported by the habit of an isotype in the Kirstenbosch herbarium.

*L. decumbens* (Boiss.) O.K. was based on a specimen collected by Dreye, no. 9374, without exact locality. Boissier stated that it was probably a monstrous form of an incompletely known species. It has fascicles of leaves on the inflorescence. No subsequent collection has been found to agree with it exactly. It is said to be distinctive in the pubescence of short tufted hairs on the scape and spikelets, while the calyx is described as quite glabrous. It seems that it is mainly the proliferous character which distinguishes it from *L. equisetum* (Boiss.) R. A. Dyer but in view of the circumstances no good purpose would be served by speculating further on the relationship between them.

As regards *L. scabrum* (Thunb.) O.K., I tried to establish a clear division between it, *L. corymbulosum* (Boiss.) O.K., *L. avenaceum* (C. H. Wright) R. A. Dyer and *L. penicillatum* Adamson, but failed to do so after the examination of a large number of specimens. However, because of the wide difference between extreme forms, three varieties are recognized.

On the other hand several specimens collected in S.W.A. in the vicinity of Luderitz and Angra Pequena and previously regarded as forms of *L. scabrum* appear sufficiently distinct to warrant specific rank. They differ from *L. scabrum* in the almost completely membranous bracts on mature scapes and their branches, in having 3-4-flowered spikelets and pedicellate flowers. In these latter characters and the pedicellate flowers the species shows an affinity with *L. dregeanum* but again the bracts are distinctive. The specimens are described under the new name *L. membranaceum*.

Other unusual specimens associated with *L. scabrum* and producing tufts of leaves on the flowering scapes, have been described under the name *L. foliosum* R. A. Dyer. Compton (18168) refers to the tufts of leaves within the inflorescence as a form of "vivipery". This feature is found occasionally in other species also, such as *L. scabrum*. Had *L. kraussianum* (Buchnig ex Krauss) O.K. been recorded with *L. scabrum*, I would have been tempted to suggest that hybridisation had been at play to produce *L. foliosum*.

In the case of *S. linifolium* (L.f.) O.K., two varieties are recognized. The identity of the specimen described by L.f. has not been confirmed, but the specimen in Thunberg's herbarium (?type) matches several specimens collected later in the Port Elizabeth-Uitenhage districts. But this, the probable nomenclatural type form has a limited distribution, and the second variety given the name *maritimum* is far more widespread and occurs further east in the Cape (Transkei) than any other species. The two varieties cover much the same field of distribution as *L. scabrum*. The inter relationship between *L. linifolium* and *L. scabrum* is obscure but there are specimens, for instance Britten 5022, and others collected by South and Compton, at Port Alfred (Kowie) which seem to have some characters of both, with a greater leaning to *L. scabrum*.

The circumscription of *L. dregeanum* (Presl.) O.K. and *L. pedicellatum* (Wallr. ex Boiss.) O.K. entailed similar difficult decisions. Specimens described by Boissier under the name *Statice pedicellata*, were at one time considered to be specifically distinct



from *L. dregeanum* because of the differences in the branching of the scapes and general habit, one tufted and the other mainly cushion-shaped, but after several changes in opinion *L. dregeanum* alone has been maintained.

The taxonomy of the genus *Limonium* in southern Africa seems to bristle with problems, most of which require intensive field work to crystalize them out, let alone discover their explanation. Hybrid populations are suspected as occurring frequently on the south western coast. *L. anthericoides* (Schlechter) R. A. Dyer seems unique among the species. Although it exhibits a considerable degree of morphological variability, it does not seem to have been involved in any of the reproductive problems of any of its several neighbours in the rich Caledon, Bredasdorp, Swellendam region.

The new names and name changes consequent on the above notes are summarized below in alphabetical order.

***Limonium depauperatum*** R. A. Dyer, comb. nov., stat. nov., *Statice equisetina* var. *depauperata* Boiss. in DC. Prod. 12: 658 (1847); Wright in F.C. 4, 1: 422 (1906).  
Type: Cape; Burchell 512 (G, lects.).

***L. linifolium*** (L.f.) OK. var. *linifolium*.

***L. linifolium*** var. *maritimum* (E. and Z. ex Boiss.) R. A. Dyer, comb. nov.  
*Statice linifolia* var. *maritima* E. and Z. ex Boiss. in DC. Prod. 12: 657 (1848); Wright in F.C. 4, 1: 421. *S. linifolia* var. *brachyphylla* Boiss. in DC. Prod. 1.c. 657; Wright in F.C. 1.c. 421.

***L. longifolium*** (Thunb.) R. A. Dyer, comb. nov.  
*Statice longifolia* Thunb. Prod. 54 (1794). Type: Cape: Swartland, Thunberg (UPSV, holo.).

*S. purpurata* L. var. *longifolia* Boiss. in DC. Prod. 12: 667 (1848); Wright in F.C. 4, 1: 420 (1906) as to citation of *S. longifolia* Thunb.

*Limonium fergusonae* L. Bolus in J. S.A. Bot. 24: 124 (1934). Type: Riversdale, Ferguson BOL 20081 (holo.).

***Limonium membranaceum*** R. A. Dyer, sp. nov., *L. scabro* (Thunb.) O.K. affine, sed bracteis scapi et ramulorum scapi fere omnino membranaceis, spiculis 3–4-floris differt.

Perenne caespitosum demum basi lignosum. *Folia* obovata vel oblanceolata vel lineari-oblanceolata, 2–4 cm longa 4–10 mm lata, obtusa, supra tuberculis centro punctato-impressis scabra, subtus levis vel tuberculis similibus paucis. *Scapi* nonnulli, tuberculis centro punctato-impressis scabri, patentes 10–20 cm longi, erecti etiam infra medium ramos steriles articulatum multifidos primum breves sursum sensim ampliatis edentes, superioribus floriferis dense fastigiato-corymbosis, articulis omnium densis brevibus strictis. *Spiculi* 3–4-flori, bractea exterior 3.5–4 mm longa, obtusa, margine membranacea glabra, pedicellis persistentibus 0.5–0.75 mm longis, truncatis. *Calyx* 4 mm longus, subcylindricus glaber 5-costatus, limbo membranaceo, lobis 5, c. 5 mm longis. *Petala* caerulea oblineari-lanceolata, plus 1 cm longa.

Endemic in southern South West Africa.

SOUTH WEST AFRICA.—Luderitz: Pole Evans H 19355; Kinges 2031; Merxmüller 2251 (PRE, holo. M, iso.). Angra Pequena: Marloth 1160; Galpin and Pearson 7490.

This species is allied to *L. scabrum* (Thunb.) O.K. and is distinguished by the almost completely membranous bracts on the scape, by the 3–4-flowered spikelets and pedicellate flowers. It is distinguished from *L. dregeanum* (Presl.) O.K. also by the membranous bracts, by the dense asperities on the scape, and by the broader leaves with dense asperities on the upper surface.

***L. perigrinum*** (Bergius) R. A. Dyer comb. nov.  
*Statice perigrina* Bergius, Descr. Pl. Cap. 80 (1767) excl. syn. Type C.B.S. Grubb. (SBT, holo) [collected by Auge fide Thunb. Fl. Cap. VII (1823)].



- L. scabrum** Thunb. var. **avenaceum** (C. H. Wright) R. A. Dyer.  
*Statice avenacea* C. H. Wright in Fl. Cap. 4, 1: 423 (1906). Type: Bredasdorp, Ratels River Mouth, *Bolus* 8576 (K, holo. BOL iso.!).
- Limonium avenaceum* (C. H. Wright) R. A. Dyer in Kew Bull. 1932: 155.
- L. scabrum** (Thunb.) O.K. var. **corymbulosum** (Boiss.) R. A. Dyer.  
*Statice corymbulosa* Boiss, in DC. Prod. 12: 658 (1848). Type: Camps Bay, Krauss (G, holo!).
- Limonium corymbulosum* (Boiss.) O.K. in Rev. Gen.: 2: 395 (1891).
- L. penicillatum* Adamson in S.A., Journ. Bot. 7: 202 (1941); Fl. Cap. Penin. 666 (1950)  
 Type: Cape; Chapmans Peak, *Adamson* 859 (BOL holo.).
- L. scabrum** (Thunb.) O.K. var. **scabrum**.  
*L. scabrum* (Thunb.) O.K. Rev. Gen. Pl. 2: 396 (1891). Type: Cape; *Thunberg* (UPSV holo.).
- Statice scabra* Thunb., Prod. 54 (1794).

R. A. DYER

## SCROPHULARIACEAE

**Sutera dentatisejala** *Overkott*, sp. nov., a *S. cooperi* Hiern planta annua minore, foliis non rigidis neque pallidis neque cordati-rotundatis, tubo corollae longiore lobis emarginatis; a *S. pristisejala* Hiern foliis non pinnatifidis, floribus maioribus non purpureis, lobis emarginatis differt.

*Radix* annua, fibrosa, griseo-brunnea. *Herba* foetida (teste coll.) ad 22 mm alta e basi multiramosa. *Caules* decumbentes vel ascendentes, foliosi, basin versus saepe radicanes, leviter quadranguli, superne fere teretes et florigeri; ubique pilis satis longis, perspicuis, glandulosis, fuscis-capitulatis et paucis pilis simplicibus obtecti. *Folia* membranacea, opposita, omnia breviter petiolata, petiolis planis ad 6 (-12) mm longis, glandulosi-pilosis, in axillis saepe ramulos parvos foliosos gerentia, rotundati-triangulara, basi late cuneata, margine irregulariter dentata vel leviter pinnatisecta, utrinque glandulosa, ad 10 (-20) mm longa, ad 8 (-17) mm lata, nervis alternantibus pinnatis, superne immersis, subtus prominentibus, pilos conspicuos gerentibus. *Internodia* 12-27 mm longa. *Flores* plerumque alternantes, albi vel rosei, lutei-ocellati in axillis bractearum foliis similium quamquam minorum. *Pedicellus* ad 5 mm longus, calyce brevior. *Calyx* ad 7 mm longus, ut caules intus et extus glandulosi-pilosus, ad basin fere divisus. *Sepala* cuneata, apice 1-7 dentata vel mucronata. *Tubus corollae* calyce 2.5-plo longior, ad 18 mm longus, extus glandulosi-pilosus, apice leviter ampliatus. *Limbus* pro rata latus, subtus glandulis sessilibus insitus, lobis obcordatis, leviter vel distincte emarginatis, ad 5.5 mm longis, ad 3 mm latis. *Faux* glandulosa et pilosa. *Stamina* inclusa. *Antherae* reniformes inter se aequales, superiores paulo minores. *Thecae* confluentes. *Filamenta* glandulosa, superiora breviora, ad 1.2 mm, inferiora ad 2 mm longa et in tubus decurrentia, omnia in parte tertia superiore tubi inserta. *Ovarium* angustum, ad 2.5 mm longum, apice dense glandulosum. *Stylus* crassus, plerumque glaber, apice brevissime bilobatus, longe persistens. *Fructus* non vidi.

**NATAL.**—Bergville District: on boulder bed of Tseksetseke River, Cathedral Peak Forestry Station, 6,700 feet, *Killick* 1827 (PRE, holo.). Estcourt District: Giants Castle, *Symons* (Transvaal Museum No. 25157, PRE).

**BASUTOLAND.**—Likoloberg, grassy gravelly patch on hill, 9,300 feet, *Guillarmod* 716 (PRE); Mamalapi, streambank, 8,000 feet, *Guillarmod* 677 (PRE); Mamalapi, streambanks, 9,000 feet, *Compton* s.n. (NBG); Machochi, *Seligman* s.n. (BM); without precise locality, *Staples* 259 (PRE).



FIG. 6.—*Sutera dentatisepala* Overkott; A, habit,  $\times \frac{2}{3}$ ; B, flower,  $\times 3$ ; C, calyx and pistil,  $\times 3$ ; D, flower opened out,  $\times 3$ .

Decumbent or ascending, probably annual herb, about 25 cm high, much branched from the base. *Leaves* opposite, rotundate-triangular, broadly cuneate at the base; petioles shorter than the leaves, sometimes bearing short foliate branchlets in the axils. *Bracts* leaflike, but smaller. *Flowers* white or mauve with orange centres, alternate, axillary, subterminal, not very numerous; peduncles shorter than the bracts; calyx deeply 5-cleft, segments cuneate at the base, with one to seven teeth at the ends, as branches and leaves covered on both sides with short, gland-tipped hairs and globose sessile glands; tube about 18 mm long, glandular puberulous outside, lobes  $\pm$  emarginate; *Stamens and style* enclosed in the tube; filaments glandular, the upper one shorter than the lower ones. *Ovary* small, with numerous sessile glands; style stout, persistent.

O. OVERKOTT

## TURNERACEAE

**Turnera thomasii** (Urb.) Story, comb. et stat. nov. *T. ulmifolia* L. var. *thomasii* Urb. in Engl. Bot. Jahrb. 25 Beibl. 60: 11. *Loewia thomasii* (Urb.) Lewis in Kew Bull. 1953: 431. 5360

**Turnera oculata** Story, sp. nov., *T. ulmifoliae* L. et *T. thomasii* (Urb.) Story a ffinissed ita differens: a *T. ulmifolia* ramis rigidibus, a *T. thomasii* petalis flavis, indumento breviori, antheris multo crassioribus.

*Frutex* erectus tenuis ad 2 m altus, foliis ramulisque junioribus villis simplicibus stellatisque dense pubescentibus. *Folia* alternantia simplicia; lamina ad 3 cm longa 2 cm lata, obovata vel late elliptica, apice rotundato vel acuto, praeter basin cuneatam serrata, pinninervata, nervis utrinque plus minusve 6, basi saepe glandulis prominentibus 1 vel 2; petiolus ad 1 cm longus; stipuli minuti. *Inflorescentia* terminalis. *Bractae* 2 lineares 1 cm longae, superne profunde canaliculae. *Flos* axillaris solitarius, pedicello petiolo adnato. *Calyx* intus paene glaber; tubus 1.2 cm longus 3 mm diametro, nervis 10; lobi tubo calycino interdum aequilongi saepius longiores, acuminati, basi 3 mm lati, interdum margine tenue pellucido ad 2 mm lato. *Corolla* in faucibus tubi calycini inserta; petala alterna ac lobi calycini, obovata, apice acuto, imbricata, 2.5 cm longa, in parte latissima 1.8 cm lata, superne laete flava, inferne saturate rubri-brunnea, glabra. *Androecium* staminibus 5, fertilibus; filamenta lobis calycinis opposita, circiter 3 mm infra calycis fauces inserta, villis basi paucis alibi glabra, 2.2 cm libera, inferne 1 cm tubo calycino adhaerentia; antherae c. 7 mm longae, basi emarginatae, paullo super basin dorsifixae summum filamentum saepientes. *Gynoeceum* stylis 3 glabris liberis quam stamina paullo longioribus; stigma fimbriatum; ovarium superius cylindratum apice obtuso, in siccitate 5-costatum, ovulis ad 120 in placenta stipatis. *Capsula* 3-valvata, valvis ovatis 9 mm longis in parte latissima 5 mm latis, placenta parietali; funiculus prope basin seminis affixus; semina matura curvata, 4 mm longa; arillus incisus membranaceus, semen superans.

SOUTH WEST AFRICA.—Kaokoveld: sandy bed of watercourse 12 miles south of the Kunene River, latitude 17° 22' longitude 12° 30' Story 5778; sandy banks of Kunene River at Otjinungwa, de Winter and Leistner 5770 (PRE, holo.).

An erect slender shrub up to 2 m high, younger parts densely pubescent with simple and stellate hairs, branches sometimes abbreviated, with crowded small leaves, afterwards deciduous or elongating and permanent. *Leaves* velvety, dull light green, simple, very variable in size; lamina up to 3 cm long and 2 cm broad, obovate to broadly elliptic, rounded or acute at the apex, apiculate-serrate except at the cuneate base, alternate, divergent, pinnately nerved with about six pairs of nerves more prominent below, often with one or two conspicuous hollow glands (2  $\times$  1 mm) on the margin at the base; petiole up to 1 cm long; stipules minute, free, exuding a drop of resin

from the glandular tip. *Inflorescence* terminal; bracts 2, linear, 1 cm long and deeply channelled adaxially, with sometimes one or several glands like those found on the leaves but much smaller. *Flower* axillary, solitary, with pedicel fused to petiole and thus at first sight apparently sessile and borne at the distal end of the petiole. *Calyx* almost glabrous within; tube about 12 mm long and 3 mm in diameter, widening at the throat, and with 10 veins of which five continue down the centres of the lobes and five fork between the bases of the lobes to form two marginal veins; lobes sometimes as long as the calyx tube, but more often 3 or 4 mm longer, acuminate, 3 mm wide at the base, sometimes with a thin translucent margin up to 2 mm wide. *Corolla* inserted in the throat of the calyx tube; petals alternating with the calyx lobes, obovate, acute at the apex, abruptly narrowed below, imbricate, 2.5 cm long, 1.8 cm wide at the widest part, bright yellow above, dark red-brown towards the base, glabrous. *Androecium* of 5 stamens, all fertile; filaments inserted about 3 mm below the throat of the calyx tube and alternating with the petals, glabrous except for a few hairs near the base, free for about 2.2 cm, below this with thin transparent margins adherent to the calyx-tube and a thicker central part free to the base, this fixed portion being about 1 cm long; anthers 7 mm long, narrowly oval, emarginate at the base, dorsifixed a little above the base and enclosing the tip of the filament; thecae dehiscing longitudinally.



FIG. 7.—*Turnera oculata* Story; 1, seed,  $\times 10$ ; 2, stigma,  $\times 10$ ; 3, anther,  $\times 10$ ; 4, leaf-glands,  $\times 10$ ; 5, flower,  $\times 1.5$ .



*Gynoecium* with 3 glabrous free styles a little longer than the stamens; stigma fimbriate; ovary superior, cylindric, obtuse, 5-ridged when dry, ovules up to 120, crowded on the placenta. *Capsule* 3-valved; valves ovate, 9 mm long, 5 mm broad at the broadest part, thickened on the margin, reticulate within, with parietal placenta; funicle attached just above the base of the seed and remaining on the placenta after the seed is shed, thickened near the hilum; mature seeds curved, 4 mm long, with hilum near base on concave side, abortive seeds conspicuous by reason of the rudimentary aril; aril lobed, incised, membranous, roughly triangular, with one lobe overtopping the seed on the concave side and two almost encircling the base.

This plant was first recorded in 1956 in a sandy gully about 12 miles south of the Kunene River in South West Africa at longitude  $12^{\circ}30'$ , latitude  $17^{\circ}22'$ , and has so far been found only in that vicinity. It is not common and usually occurs in small patches of a dozen or so. It has been found in bloom in May and August, conspicuous because of the large bright flowers and silvery leaves and erect habit. As one of the several young plants collected in the field has survived a severe winter in Pretoria and seems well established, it is likely that *Turnera oculata* could be cultivated fairly widely in the Union.

The plant runs to *Turnera* in Thonner's key and its other characters are also strongly in support of its inclusion under *Turnera*, and I therefore do not feel justified in placing it in the closely related genus *Loewia*, even though *Loewia* is upheld in the Flora of Tropical East Africa (Lewis 19/2/54, l.c.: 1 et seqq.). The two genera are separable as follows:—

1. *Turnera* has a 10-nerved calyx-tube, *Loewia* has the calyx-tube traversed by 35–40 bundles of very slender vessels (Urban 1897, Ann. R. Inst. Bot. Rom. 6: 189).
2. *Turnera* has no secretory hairs, *Loewia* has tubercles secreting resin (Urban l.c.). (These "tubercles" are resin-like nodules, probably swollen hair-bases.)
3. *Turnera* has the stigma fimbriate—"capillaceo-multifidum"—(Linn. Gen. ed. 2: 105 para. 297), *Loewia* according to Urban (l.c.), Thonner, and Hooker (Icon. 3015) has it capitate or with the margin sub-entire. (Lewis says of *L. tanaensis* that the stigma is fimbriate but shows it lobed in the sketch.)

In all these characters the plant here described agrees with *Turnera*. Additional reasons for keeping it separate from *Loewia* are as follows:—

1. In *Loewia* the calyx-tube is about two-thirds the length of the whole calyx, in this plant it is less than half the total length.
2. *Loewia* has the seeds bi-seriate on the placenta (Urban l.c.), this plant has them crowded.
3. *Turnera* may have the pedicels fused with the petioles (R. Hort. Soc. Dic. of Gard. 1951 Vol. 4: 2170; Hooker's Jour. Bot. 4, 1842: 115), in *Loewia* they are free. This plant has them fused.
4. *Turnera* may have conspicuous hollow glands on the basal margins of the leaves, in *Loewia* they are absent. This plant has them, though not consistently so.

Two inconsistencies in the literature should be pointed out. They are as follows:—

1. Urban (l.c.) says that in *Loewia* the margin of the aril is sub-entire, but Hooker (Icon. 3015) says of Urban's species *L. tanaensis* that the margin is lacerate. Hooker's statement has been checked at Kew and found to be correct.
2. Lewis (Flor. Trop. E. Afr. 1954) says the pits on the seed of *Loewia* are two-pored, Urban (l.c.) says they have no pores. The specimens at Kew indicate that Urban is correct.

For the following reasons I am including *Loewia thomasii* (Urb.) Lewis under *Turnera*:—

1. It has no secretory hairs.
2. The calyx is tubular for less than half the total length.
3. The pedicels are fused with the petioles.
4. There are conspicuous hollow glands on the basal margins of the leaves.
5. The calyx-tube is 10-nerved.
6. The stigma is fimbriate (described incorrectly by Urban as very shortly lobed).

The available records indicate that *Turnera thomasii* has been collected only twice. The first collection is by F. Thomas (No. 47) from Witu in the Lamu district of Kenya, and is the type. The holotype was destroyed in Berlin, and there remains only the isotype, which is at Kew. The second collection is by P. Bally (No. 2092) at Mahoney Road, near Muddo Gasha in the Northern Province of Kenya, and is represented in the Kew and Nairobi herbaria.

I am grateful to Mr. W. Marais, who went through the material and literature at Kew on my behalf and gave me much useful information.

R. STORY

# The Virus Diseases of *Crotalaria*, *Glycine* and *Medicago* Species

by

Patricia J. Klesser

*Division of Plant Pathology*

This report concerns the naturally occurring virus diseases of the following plants:—*Crotalaria juncea* (sunhemp), *C. spectabilis*, *Glycine max* (soybean), *G. javanica* and *Medicago sativa* (lucerne or alfalfa).

Throughout South Africa, these genera are used either for fodder, as cover crops, or, to a lesser extent, for oil extraction.

Further details of some of the diseases found on these plants, will be found in the reports on bean and broad bean virus diseases, as the viruses were apparently related to those groups.

## METHODS AND MATERIALS

The viruses were isolated from plants collected mainly in the Transvaal, but also from the Stellenbosch district and from near Salisbury, Southern Rhodesia.

The standard test plants were: *Phaseolus vulgaris* var. Canadian Wonder, *Vicia faba* var. Aquedulce, *Pisum sativum* var. Greenfeast and *Vigna unguiculata* var. Dr. Saunder's Upright.

Carborundum powder was used for the mechanical sap inoculations, and *Aphis craccivora* was used in the insect transmission tests.

There are three separate sections, dealing with the viruses of (A) *Crotalaria* spp. (B) *Glycine max* and (C) *Medicago sativa* and *Glycine javanica*.

Each section has its own bibliography and plates.

## CROTALARIA VIRUS DISEASES

*Crotalaria juncea*, sunhemp, is cultivated extensively in South Africa as a green manure crop. *Crotalaria spectabilis* is also used for this purpose but on a smaller scale.

Both species are subject to natural infection by several viroses in the field, and are also susceptible to many others when inoculated artificially.

With two exceptions, these virus diseases have been described in previous papers, as they were obviously related to other viruses viz. the bean local chlorosis, the bean chlorotic ringspot, the bean necrosis and the bean necrotic speckle viruses. Also, a strain of the broad bean mosaic virus was found on naturally infected *C. spectabilis*.

The two exceptions, which will be described in detail in this paper, are the alsike clover mosaic virus and the white clover mosaic virus complex. Both are well-known elsewhere, but are recorded for the first time in South Africa.

The symptoms caused on most host plants, by what is considered to be the white clover mosaic virus, are very similar to those described by Zaumeyer and Wade (19). No attempt has been made to split the components [see Johnson (13)], but the virosis as found in the field is described as a whole.

The symptoms caused by the several viruses on *C. juncea* are very similar—the differences are found in the degree of malformation, mottling or necrosis rather than in the type of symptom. They are only differentiated by the effect of the virus on other plants.

On *C. spectabilis* the symptom picture does vary—some viruses cause vivid yellow streaks, while others result in mottling with necrosis.

Nevertheless, they are not characteristic enough for certain identification, and alternate hosts must be used.

## REVIEW OF LITERATURE

The first report of probable virus infections of *Crotalaria* species was that of Schwartz, 1927, who described a witch's broom and crinkle disease of *C. juncea* and *C. anagyroides* in Java (17).

In 1931, Illingworth (11) noted a mosaic of *Crotalaria*s in pineapple fields in Hawaii, and Cook (5, 6) worked on a mosaic disease of *C. striata* in Puerto Rico. Other mosaic diseases of *Crotalaria* spp. were found in Japan by Fukushi (8), and in Trinidad by Dale (7).

Raychaudhuri (15) noted a mosaic disease which is confined to sunnhemp only (*C. juncea*) and Capoor (4) described the Southern sunnhemp mosaic virus which withstands very high temperatures and ageing.

Gates (9) reported mosaic and "little leaf" diseases of *C. spectabilis*, Jenson (12) worked on the aphid transmission of a mosaic of *C. incana* and Raychaudhuri and Pathanian (16) found a mosaic of *C. striata*.

Viruses causing a witch's broom symptom on *Crotalaria* spp. were recorded by Johnson and Lefebvre (14) who were able to transmit the virus to broad bean; and Hadiwidjaja (10) who transmitted the virus by grafting and by *Cuscuta*.

Bose and Misra (3) reported a graft-transmissible virus which caused structural abnormalities of sunnhemp flowers. This was later proved to be due to two viruses—one sap-transmissible, and the other, probably tobacco leaf-curl transmitted by *Bemisia tabaci* (1).

According to Zaumeyer (18), mosaic symptoms can be induced on *Crotalaria* spp. by artificial inoculation with several legume viruses viz. alsike clover mosaic viruses 1 and 2 and pea mosaic viruses 4 and 5.

## ALSIKE CLOVER MOSAIC VIRUS 1 Zaumeyer and Wade.

Natural source of virus: *Crotalaria juncea*.

The young leaves showed a chlorotic speck mottle and they had wavy margins. The middle leaves had constrictions across the laminae, and irregular-shaped dark green islands on a light green background. The lower leaves were normal in shape but had dark green veinbands or midrib. Fig. 1A.

Physical properties: Thermal inactivation point 62–64°C. Longevity *in vitro* 1–2 days. Dilution end point 1:3000–1:5000.

Transmission: Mechanical sap inoculation. *Aphis craccivora*.

Host range: *Crotalaria juncea* L., *C. spectabilis* Roth., *Dolichos lablab* L., *Glycine javanica* L., *G. inax* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.



## REACTION OF SUSCEPTIBLE SPECIES

*Crotalaria juncea.*

Local. Necrotic lesions may develop.

Systemic. In nine days chlorotic spots develop on the young leaves. Later leaves have a mottle or mosaic with dark green blisters or veinbands. These leaves are puckered, malformed and elongated. There may also be necrotic specks. Fig. 1B. The plant is stunted and rosetted.

*C. spectabilis.*

Local. Chlorotic spots may develop.

Systemic. There are chlorotic spots on the young leaves in 19 days. Later leaves are chlorotic with dark green veinbands and there is a necrotic sheen. These leaves are malformed and puckered.

*Dolichos lablab.*

A symptomless carrier.

*Glycine javanica.*

Local. There are chlorotic spots in seven days.

Systemic. There may be a chlorotic spotting or mottle.

*G. max.*

Local. Chlorotic spots develop in seven days.

Systemic. There may be chlorotic areas, but usually the virus is latent.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. The leaves are rolled and mottled.

*Lupinus albus* var. Sweet.

Local. The leaves drop after a severe necrosis in three days.

Systemic. In 16 days the young leaves develop a vein clearing and spotting and they remain folded, and have wavy margins. Later leaves are mottled and malformed and may have necrotic specks. The plant is rosetted and many leaves drop.

*L. albus* var. Bitter.

Local. No reaction.

Systemic. The young leaves remain folded and have curled tips. Later leaves are mottled or generally chlorotic and the plant is rosetted.

*L. luteus.*

Local. No reaction.

Systemic. The young leaves remain folded and have wavy margins. Chlorotic spots develop in 20 days. Later leaves are small, malformed (stringlike) and generally chlorotic. There may be necrosis and many leaves drop. The plant is rosetted.

*L. mutabilis.*

Local. No reaction.

Systemic. The leaves are malformed and stringlike, and very chlorotic. The plant is rosetted.

*Medicago lupulina.*

Local. No reaction.

Systemic. After a vein clearing there are vivid chlorotic streaks and areas, and the leaves are crinkled. Fig. 1C.

*Melilotus officinalis.*

Local. No reaction.

Systemic. The young leaves develop chlorotic spots and streaks. Later leaves are mottled, small and malformed.

*Phaseolus acutifolius.*

Local. In six days there are chlorotic spots and necrotic veins.

Systemic. The young leaves develop a vein clearing and then necrosis in the veins. Later leaves are mottled.

*P. lunatus.*

Local. Chlorotic ringspots develop in six days.

Systemic. There is a chlorosis of the veins which soon becomes necrotic.

*P. mungo.*

Local. There are chlorotic spots in eight days.

Systemic. There is a chlorotic spotting on most leaves.

*P. vulgaris* var. Canadian Wonder.

Local. No reaction.

Systemic. A chlorotic network develops on the young leaves, and later ones have a chlorotic spotting and then a mottle. There are dark green areas and veinbands and the leaves are puckered.

var. Haricot.

Local. No reaction.

Systemic. After a chlorotic network and spotting, the leaves develop a mottle. The leaf surface is puckered and many leaves drop. There may be a slight malformation.

*Pisum sativum.*

Local. No reaction.

Systemic. The young leaves develop a chlorotic network in 15 days. Later leaves have chlorotic spots or a mottle, and are malformed. The old leaves have a white etching. Fig. 1D. The tendrils are abnormally curled, and the plant is stunted.

*Trifolium hybridum.*

Local. No reaction.

Systemic. There is a vein clearing and chlorotic spotting followed by a chlorotic streaking.

*T. incarnatum.*

Local. There may be dark green rings on the chlorotic leaves.

Systemic. The young leaves show a vein clearing after six days, then chlorotic spotting or vein flecking. Later leaves have a mosaic and are crinkled and rosetted.

*T. pratense.*

Local. No reaction.

Systemic. There may be chlorotic streaks or the plant may be a symptomless carrier.

*Vicia faba.*

Local. No reaction.

Systemic. Only a diffuse chlorotic mottle develops.

*Vigna sesquipedalis.*

Local. There are chlorotic spots in seven days.

Systemic. In 15 days the young leaves develop a vein clearing and chlorotic spotting. Later leaves are mottled.

*V. unguiculata.*

Local. Chlorotic spots may develop.

Systemic. There may be a vein clearing followed by a chlorotic mottle, or the leaves may be symptomless.

*Voandzeia subterranea.*

Local. There are chlorotic areas in seven days.

Systemic. The symptoms are masked.

## IDENTIFICATION.

This virus is very similar to the alsike clover mosaic virus 1 Zaumeyer and Wade (19). The only difference is that on the broad bean, Zaumeyer's virus induces a severe mottle and malformation, whereas this virus causes only a diffuse mottling. This difference may be due to temperature or varietal factors.

Nevertheless, it is considered the same as, or closely related to the alsike clover mosaic virus 1.

## WHITE CLOVER MOSAIC VIRUS Zaumeyer and Wade.

Natural source of virus: *Crotalaria spectabilis*.

The younger leaves showed a chlorotic mottle, and the older ones, a dark green vein banding. There were necrotic stem streaks. Fig. 2C.

Physical properties: Thermal inactivation point 56–58°C. Longevity *in vitro* 1–2 days. Dilution end point 1:1000–1:2000.

Transmission: Mechanical sap inoculation.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Dolichos lablab* L., *Glycine javanica* L., *G. max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *M. sativa* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

## REACTION OF SUSCEPTIBLE SPECIES

*Arachis hypogaea.*

Local. No reaction.

Systemic. Chlorotic spots develop on the young leaves; on later formed ones, there is a chlorotic streak mottle.

*Crotalaria juncea.*

Local. Within a week there are chlorotic spots and necrotic veins. The leaves soon drop.

Systemic. In nine days the young leaves develop a vein clearing and chlorotic spotting. Later leaves are small and crinkled, and have a mosaic and a necrotic sheen. There are often necrotic stem streaks which cause the plant to curve to one side.

*C. spectabilis.*

Local. No reaction.

Systemic. The young leaves develop a chlorotic flecking and the next formed have a mottle. Later leaves develop a vein banding with a slight necrosis which causes a crinkling of the leaves.

*Dolichos lablab.*

Local. Chlorotic spots develop in 5-6 days.

Systemic. No reaction.

*Glycine javanica.*

A symptomless carrier.

*Glycine max.*

Local. Small necrotic specks with chlorotic haloes develop in 10 days.

Systemic. At the same time the young leaves develop a vein-clearing and chlorotic spotting. Later leaves have a mottle with necrosis developing in the chlorosis. This results in a puckering of the leaf surface.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. After two weeks most leaves develop a chlorotic streak mottle and they are rolled.

*Lupinus albus.*

Local. In nine days necrotic specks and veins develop, leaving a chlorotic background. The leaflets soon drop.

Systemic. The young leaves show a vein-clearing and spotting with necrotic specks. Later leaves are mottled and rolled, and the necrosis spreads until most leaves have dropped leaving the rosetted petioles. Any secondary shoots have small malformed leaves with dark green blisters.

*L. luteus.*

Local. In 10 days there are chlorotic spots.

Systemic. At the same time the young leaves develop a chlorotic network or vivid rings. Later leaves are mottled and malformed, and they remain folded. The older leaves have chlorotic spots with necrotic rings. The plant is severely stunted and rosetted.

*L. mutabilis.*

Local. No reaction.

Systemic. The leaves curl up, and are small and chlorotic. The plant is rosetted and stunted.

*Medicago lupulina.*

Local. No reaction.

Systemic. The leaves show chlorotic streaks and a dark green midrib. The plant is stunted.

*M. sativa.*

Local. No reaction.

Systemic. The young leaves develop chlorotic spots in three weeks. Subsequent ones show almost yellow spots or irregular areas.

*Melilotus officinalis.*

Local. There are dark green rings on chlorotic leaves.



Systemic. The young leaves show diffuse chlorotic spots. Later ones develop an irregular chlorotic mottle.

*Phaseolus acutifolius.*

Local. There is no reaction but the leaves drop.

Systemic. In 8-10 days there is a veinclearing and curling of the young leaves. Later ones are small and malformed, and have dark green blisters.

*P. lunatus.*

Local. In 10 days there are necrotic specks with chlorotic haloes, and a veinal necrosis.

Systemic. The first and second trifoliates develop necrotic rings, and the young leaves have chlorotic specks with necrosis setting in.

*P. mungo.*

Local. In 10 days there are necrotic lesions.

Systemic. Some leaves have chlorotic specks which later become necrotic.

*P. vulgaris* var. Canadian Wonder.

Local. There are necrotic lesions or ringspots and a slight veinal necrosis.

Systemic. No reaction.

var. Haricot.

Local. Within a week there may be small chlorotic spots with necrotic rings, or only a veinal necrosis.

Systemic. The young leaves develop a veinal necrosis which spreads to the petioles and stem, and the plant collapses.

vars. Black Wonder, Long Tom, S.A. Black and White and Tendergreen develop large local necrotic spots and veins in three days. There are also areas of almost yellow chlorosis on which the necrotic lesions are vividly marked. Fig. 2B.

var. Idaho Refugee has only a local necrotic vein etching.

*Pisum sativum.*

Local. There are no lesions, but in 10 days the leaves have become necrotic and wilted.

Systemic. After a veinclearing and spotting of the young leaves, the next formed develop a mosaic. Necrosis sets in, in the chlorotic areas and in the veins, and the plant collapses. Secondary shoots have small, folded and mottled leaves, and the tendrils are abnormally curled.

*Trifolium hybridum.*

Local. There are chlorotic spots.

Systemic. After three weeks chlorotic spots develop on the young leaves while later ones have a chlorotic streak mottle.

*T. incarnatum.*

Local. A veinal necrosis results in a collapse of the leaves.

Systemic. In 18 days the veins of the young leaves become chlorotic then necrotic. Later ones are severely crinkled and puckered and have a mottle. The plant is extremely stunted and normally collapses.

*T. pratense.*

Local. No reaction.

Systemic. There are chlorotic streaks which become necrotic and cause a malformation of the leaf surface.

*T. repens.*

Local. No reaction.

Systemic. There are chlorotic streaks but less necrosis and malformation than on *T. pratense*.

*Vicia faba.*

Local. In two weeks chlorotic spots with almost purple necrotic rings develop. The leaves wilt.

Systemic. A week later the young leaves show a vein-clearing and chlorotic spotting. On later formed leaves these spots have necrotic haloes (Fig. 2A), and there is a necrosis of the growing point, which may collapse. Any secondary shoots which develop have leaves which are rolled and have a mosaic.

*Vigna sesquipedalis.*

Local. Chlorotic specks develop in two weeks. These fuse to a general chlorosis and the leaves wilt.

Systemic. The second trifoliates have chlorotic rings and a necrotic sheen. The young leaves are spotted and later mottled.

*V. unguiculata.*

Local. In two days there are necrotic specks and in six there are chlorotic areas.

Systemic. A week later the young leaves develop necrotic veins and they are curled down, and soon absciss. If more leaves form they are slightly malformed with irregular areas of chlorotic spots along the veins.

*Voandzeia subterranea.*

Local. No reaction.

Systemic. A dark green blistered mottle develops on most leaves.

## IDENTIFICATION

There is a great resemblance between this virus and the white clover mosaic virus as described by Zaumeyer and Wade (19).

Although the symptoms on all host plants are not identical, they are very similar. Also, the physical properties and host ranges of the two viruses are alike.

Therefore, this virus is considered the same as the white clover mosaic virus.

(No attempt has been made to isolate the two components, but the virus is described as it was found in the field.)

## SUMMARY

In South Africa, three viruses occur naturally on *Crotalaria juncea*, viz. the alsike clover mosaic virus and strains of two bean viruses (described in the report on bean virus diseases).

On *C. spectabilis* there are four viruses which occur in the field—the white clover mosaic virus (as a complex), two bean viruses and one related to the broad bean mosaic virus (described under their respective headings).

Of these seven viruses, not one can be correlated with the *Crotalaria* viruses already reported in the literature.

The viruses of Bose and Misra (3) and Hadiwidjaja (10) both cause a witch's broom effect, which is not a feature of any of these viruses.

Gate's two diseases of *C. spectabilis* are not sap-transmissible (9), and the sunnhemp

mosaic of Raychaudhuri (15) has only one host viz. sunnhemp. Although the viruses of Capoor (4) and Raychaudhuri and Pathanian (16) have much wider host ranges, their physical property values are very high e.g. Capoor's virus withstands heating up to 90°C, and ageing to 557 days.

Too few details are available of the other *Crotalaria* diseases, for an accurate comparison to be made.

Schwartz (17), Cook (5), Illingworth (11), Fukushi (8) and Jenson (12) give only the symptoms on *Crotalaria* species. Dale (7) does include cowpea as a susceptible host, and Johnson and Lefebvre (14) describe only the reaction on broad bean.

It is therefore concluded that none of these *Crotalaria* viroses have been found during this survey in South Africa.

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## SOYBEAN VIRUS DISEASES

In the field, soybean (*Glycine max*) is apparently susceptible to three viruses—one of which is the seed-borne soybean mosaic virus.

This soybean mosaic virus has been found in the Northern, Eastern and Western Transvaal—but probably occurs wherever soybeans are cultivated, as the percentage of infected seed can be high.

The other two viruses found on naturally infected soybeans are described in detail in the report on bean virus diseases; as they were proved to be strains of the bean chlorotic ringspot and bean local chlorosis viruses.

The field symptoms of the latter two viruses include mottling, puckering and malformation of the leaves, and stunting of the plants.

## REVIEW OF LITERATURE

Clinton 1916, was the first to report a chlorosis and crinkling of soybean leaves. The virus origin of this chlorosis was established by Gardner and Kendrick in 1921. Pierce (11) named the causal organism soybean virus 1, and in Kenneth Smith's classification it is *Soja* virus 1.

The virus can be transmitted in the seed of infected plants where it can survive for two years, Kendrick and Gardner (8). It is also aphid transmitted.

Heinze and Köhler (6) and Conover (3) were able to infect *Phaseolus vulgaris* and *Vicia sativa*, but these hosts have not been confirmed by other workers.

Savulescu *et al* (12) described three types of symptom on soybeans—leaf curl, brown mosaic and yellow mosaic. These variants have a thermal inactivation point of 80°C., which is much higher than is generally accepted for the soybean mosaic virus.

According to Ling (10) the only legume viruses found on naturally infected soybeans are the bean yellow mosaic virus and the cowpea mosaic virus of Dale.

However, many other legume viruses can induce symptoms on soybeans when inoculated artificially.

The top necrosis, streak and budblight diseases of soybean are now attributed to strains of the tobacco ringspot virus. Allington (1) and Johnson (7). This virus is also seed-transmitted in soybeans. Desjardins *et al* (4).

The tomato spotted wilt virus results in local necrotic specks surrounded by chlorotic haloes. The rest of the leaf may be almost orange in colour. There is no systemic reaction. (See report on pea virus diseases.)

## SOYBEAN MOSAIC VIRUS Gardner and Kendrick.

Transmission: Mechanical sap inoculation. By seed. (One land had approximately 35%.) Aphid. (Species not determined.)

Host range: *Glycine max* (L.) Merr.

Symptoms on *Glycine max*:

(a) Artificial infection in the glasshouse:

Local. No reaction.

Systemic. The young leaves develop chlorotic spots in three weeks. This is followed by a mottle and slight malformation on the next formed leaves. Often, necrotic rings develop round the chlorotic spots as the leaves mature.

The plant is stunted, and has a proliferation of secondary shoots which remain rosetted.



## (b) Natural infection in the field:

In a land of maturing soybeans, infected plants are noticeable for their lush green foliage, when other plants have dropped most of their leaves.

These plants are stunted, and have a great number of lateral branches.

The leaves are mottled, crinkled and slightly malformed. They later become leathery.

## (c) Seed infection in the glasshouse:

The primary leaves are mottled and crinkled with wavy margins. The trifoliates have the usual symptoms.

The plants are spindly and etiolated.

## IDENTIFICATION

As this virus is seed-borne, and has only one host plant viz. the soybean, there can be little doubt that it is the soybean mosaic virus.

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## LUCERNE (ALFALFA) MOSAIC VIRUSES

The typical lucerne mosaic virus occurs naturally on lucerne in many districts of the Union.

One variant of this virus was found in the Western Cape, also on lucerne; and another was isolated from *Glycine javanica* growing in experimental plots in Pretoria. These three viruses will be described below.

The necrotic ring strain of lucerne mosaic virus, which was commonly found on naturally infected peas and sweet peas, has been described in the report on the virus diseases of peas and sweet peas.

The word "lucerne" is used in preference to "alfalfa", as it is the common name for *Medicago sativa* in this country.

Natural source of virus:

- (a) **Lucerne mosaic virus—type.** (TYPE\*) *Medicago sativa*. Some leaves had a chlorotic network, spotting or streaking, while others had dark green blisters and were severely puckered.
- (b) **Lucerne mosaic virus—necrotic strain.** (NECR. STR.) *M. sativa*. The leaves were diffusely mottled and slightly malformed.
- (c) **Lucerne mosaic virus—Glycine strain.** (GLYC. STR.) *Glycine javanica*. Most leaves had irregular, vivid yellow markings. There was no malformation. See Fig. 5A.

Physical properties:

Thermal inactivation point (all 3) 62–64°C.

Longevity *in vitro*. TYPE AND NECR. STR. 2–4 days.

GLYC. STR. 6–8 days.

Dilution end point (all 3) 1:3000–1:5000.

Transmission:

All three are mechanically sap transmissible.

TYPE AND NECR. STR. *Aphis craccivora*.

*Aphis fabae*.

GLYC. STR. Results inconclusive.

## HOST RANGES.

	TYPE	NECR. STR.	GLYC. STR.
<i>Arachis hypogaea</i> L.....	+	+	
<i>Crotalaria juncea</i> L.....	+	+	
<i>C. spectabilis</i> Roth.....			+
<i>Dolichos lablab</i> L.....	+		+
<i>Glycine javanica</i> L.....	—		+
<i>G. max</i> (L.) Merr.....	+	—	+
<i>Lathyrus odoratus</i> L.....			+
<i>Lupinus albus</i> L.....	+	+	+
<i>L. luteus</i> L.....	+	+	+
<i>L. mutabilis</i> Sweet.....			+
<i>Medicago lupulina</i> L.....	+		+
<i>M. sativa</i> L.....	+	+	+
<i>Melilotus officinalis</i> Willd.....	+	—	+
<i>Phaseolus acutifolius</i> Gray, var. <i>latifolius</i> Freem.....	+	+	+

\*Abbreviations to be used in the text.

	TYPE	NECR. STR.	GLYC. STR.
<i>P. lunatus</i> L.....	+		+
<i>P. mungo</i> L.....	+		+
<i>P. vulgaris</i> L.....	+	+	+
<i>Pisum sativum</i> L.....	+	+	+
<i>Trifolium hybridum</i> L.....	+		+
<i>T. incarnatum</i> L.....	+	+	+
<i>T. pratense</i> L.....	+	—	+
<i>T. repens</i> L.....	+	+	+
<i>Vicia faba</i> L.....	+	+	+
<i>Vigna sesquipedalis</i> (L.) Wight.....	+	+	+
<i>V. unguiculata</i> (L.) Walp.....	+	+	+
<i>Voandzeia subterranea</i> Thouars.....		+	+
<i>Nicotiana glutinosa</i> L.....	+	+	—
<i>N. tabacum</i> L.....	+	+	—
<i>Solanum capsicum</i> L.....	+	+	—

## REACTION OF SUSCEPTIBLE SPECIES

*Arachis hypogaea.*

Local. No reaction.

Systemic. TYPE. A dark green mottle develops.

NECR. STR. There is an irregular chlorotic streak mottle and occasional patterns.

GLYC. STR. Not tested.

*Crotalaria juncea.*

Local. Necrotic specks develop with all three. Fig. 4B.

Systemic. TYPE. The growing point curves to one side and the young leaves have a chlorotic network. Later formed leaves develop dark green blisters, and are malformed or even stringlike.

NECR. STR. Most leaves are mottled and elongated, with wavy margins. Later, necrotic specks develop.

GLYC. STR. The leaves show a chlorotic network and then a mottle. The chlorotic areas extend across the leaf, thereby constricting the lamina.

*Crotalaria spectabilis.* Only the GLYC. STR. was tested.

Local. No reaction.

Systemic. A chlorotic speckling develops.

*Dolichos lablab.*

Local. TYPE. Small necrotic specks develop.

GLYC. STR. There is a veinal necrosis and collapse.

Systemic. TYPE. Some leaves develop a chlorotic spotting.

GLYC. STR. A vein clearing of the young leaves, is followed by yellow vein flecks on later formed leaves. The plant is stunted.

*Glycine javanica.*

Local. GLYC. STR. Small necrotic specks and veins develop in two days.

- Systemic. GLYC. STR. In three weeks the young leaves show a vein-clearing. Later formed leaves have irregular yellow areas or concentric patterns. The symptoms in the glasshouse are not as vivid as those in the field.

*Glycine max.*

- Local. TYPE. No reaction.

GLYC. STR. There are necrotic specks, rings and veins.

- Systemic. TYPE. There are chlorotic spots and later a mottle.

GLYC. STR. In three weeks the young leaves develop a chlorotic network or star flecks. Later formed leaves have vivid yellow areas, Fig. 4F and the plant is stunted.

*Lathyrus odoratus.* Only the GLYC. STR. was tested.

- Local. No reaction.

Systemic. A chlorotic mottle develops.

*Lupinus albus.*

- Local. TYPE. Necrotic specks develop in 5-6 days.

NECR. AND GLYC. STR. There are necrotic specks with chlorotic haloes. The necrosis spreads and the leaves absciss. Fig. 4G.

- Systemic. TYPE AND NECR. STR. The leaves remain folded, and they have wavy margins. There is a mottle, and fine necrotic speckling on most leaves. The plant is rosetted.

GLYC. STR. As above, but no necrosis. In addition, the leaves are malformed and almost stringlike and there are dark green blisters.

*L. luteus.*

- Local. TYPE AND NECR. STR. The leaves collapse after necrosis.

GLYC. STR. No reaction.

- Systemic. TYPE. The leaves have broad dark green veinbands, and the tips are twisted.

NECR. STR. The leaves are mottled and have necrotic specks. They remain small and the plant is rosetted.

GLYC. STR. The young leaves develop chlorotic spots. Later formed ones have irregular dark green areas or blisters. They are also malformed or stringlike, and the plant is stunted.

*L. mutabilis.* Only the GLYC. STR. was tested.

- Local. No reaction.

Systemic. The leaves are chlorotic with dark green marginal blisters. They are severely rolled.

*Medicago lupulina.*

- Local. No reaction with the TYPE AND GLYC. STR.

Systemic. TYPE. Most leaves are mottled and puckered.

GLYC. STR. There is a diffuse chlorotic streaking.

*M. sativa.*

- Local. TYPE. Necrotic specks develop in 5-6 days.

NECR. AND GLYC. STR. No reaction.

- Systemic. TYPE. The young leaves develop chlorotic spots and later ones are mottled and slightly crinkled.

NECR. STR. The young leaves have chlorotic, almost white spots, which may become necrotic. On later formed leaves there are irregular yellow areas which cause a malformation. The old leaves have chlorotic blotches.



GLYC. STR. Only a diffuse mottle develops.

*Melilotus officinalis.*

Local. GLYC. STR. Chlorotic blotches develop.

Systemic. GLYC. STR. The young leaves have chlorotic spots or streaks along the veins, which cause a distortion. Later leaves are small, crinkled and rolled, with irregular chlorotic areas. The plant is stunted.

This plant is a symptomless carrier for the TYPE virus.

*Phaseolus acutifolius.*

Local. TYPE. There are chlorotic spots and rings.

NECR. STR. There are many necrotic lesions which fuse to give a "scorch" effect.

GLYC. STR. No reaction.

Systemic. With all three, there is a vein-clearing followed by a mottle.

With the TYPE virus there are also dark green veinbands.

*P. lunatus.*

Local. TYPE. Chlorotic spots develop in 4-5 days.

GLYC. STR. There are large chlorotic blotches.

Systemic. Only with the GLYC. STR. are there chlorotic vein flecks on the older leaves.

*P. mungo.*

Local. TYPE. No reaction.

GLYC. STR. The veins become necrotic.

Systemic. TYPE. The young leaves develop chlorotic spots with necrotic centres.

GLYC. STR. There are vivid yellow vein flecks.

*P. vulgaris* var. Canadian Wonder.

Local. TYPE. There are necrotic rings with almost white centres. Fig. 3A.

NECR. STR. The lesions are similar, but they have irregular outlines. Fig. 3B.

GLYC. STR. There are necrotic lesions and considerable veinal necrosis. Fig. 3C.

Systemic. TYPE AND GLYC. STR. No reaction.

NECR. STR. Isolated necrotic lesions develop along the veins of the trifoliate leaves. (These lesions are of the same type as occur on the inoculated leaves.) They result in the uneven growth of the laminae. Fig. 3D.

var. Haricot.

Local. The necrotic lesions are similar to those on Canadian Wonder; but large areas of these leaves become chlorotic, and the leaves drop.

Systemic. NECR. STR. There is often a severe veinal necrosis which results in the collapse of the plant.

*Pisum sativum.*

Local. TYPE AND GLYC. STR. No reaction.

NECR. STR. There are necrotic lesions in 5-6 days.

Systemic. TYPE. After a vein clearing of the young leaves the next ones develop chlorotic spots. Older leaves have a chlorotic vein etching.

NECR. STR. No reaction.

GLYC. STR. The leaves are mottled and malformed, and they remain folded. The tendrils are abnormally curled.

*Trifolium hybridum.*

Local. GLYC. STR. No reaction.

Systemic. GLYC. STR. There are chlorotic streaks and rings, and on later formed leaves, a general chlorosis. As the leaves mature, necrosis sets in, in the chlorosis.

This plant is a symptomless carrier of the TYPE virus.

*T. incarnatum.*

Local. TYPE. The leaves become chlorotic leaving dark green rings with central necrotic specks.

NECR. AND GLYC. STR. No reaction.

Systemic. With all three there is a chlorotic network followed by a mosaic, and the leaves are crinkled.

TYPE. In addition, the plants are severely stunted and rosetted. Fig. 4E.

GLYC. STR. There are well-defined dark green veinbands on most leaves. Fig. 4D.

*T. pratense.*

Local. TYPE AND GLYC. STR. Necrotic specks develop in 5-6 days.

Systemic. TYPE. Some plants have a chlorotic mottle, but with others, the virus is latent.

GLYC. STR. The virus is latent but can be recovered.

*T. repens.*

Local. TYPE. No reaction.

Systemic. TYPE. Chlorotic streaks develop.

This plant is a symptomless carrier for both the NECR. and GLYC. strains.

*Vicia faba.*

Local. With all three there are red necrotic lesions which may fuse with closely adjacent ones. Fig. 4A.

The leaves become flaccid and absciss.

Systemic. TYPE. No reaction.

NECR. STR. After an initial vein-clearing there may be a lethal necrosis.

GLYC. STR. A diffuse chlorotic mottle develops.

*Vigna sesquipedalis.*

Local. TYPE. Chlorotic spots develop.

NECR. AND GLYC. STR. There are necrotic specks.

Systemic. TYPE AND NECR. STR. After a vein clearing there is a chlorotic speck mottle.

GLYC. STR. No reaction.

*V. unguiculata.*

Local. TYPE. There are small necrotic lesions. Fig. 4C.

NECR. AND GLYC. STR. In addition, the rest of the leaves become chlorotic, and they soon drop.

Systemic. TYPE AND GLYC. STR. There is a diffuse mottle.

NECR. STR. Chlorotic spots and necrotic specks develop on the young leaves. On the older ones there are necrotic rings, and the leaves absciss.

*Voandzeia subterranea.*

Local. NECR. AND GLYC. STR. No reaction.

- Systemic. NECR. STR. There are chlorotic spots and later a mottle.  
 GLYC. STR. The leaves are small and puckered, and they are mottled with dark green veinbands and blisters.

*Nicotiana glutinosa.*

Local. TYPE AND NECR. STR. There are small necrotic rings with almost white centres. Fig. 5B.

Systemic. TYPE AND NECR. STR. A chlorotic spot mottle develops.

*N. tabacum.*

Local. TYPE. Chlorotic spots develop in six days.

NECR. STR. There are irregular almost white lesions.

Systemic. TYPE. No reaction.

NECR. STR. There is a diffuse chlorotic spotting.

*Solanum capsicum.*

Local. TYPE. There are chlorotic spots in six days.

NECR. STR. Necrotic lesions develop.

Systemic. TYPE. The leaves are mottled and malformed or cupped.

NECR. STR. There are necrotic rings or irregular patterns which result in a malformation of the leaf.

#### IDENTIFICATION.

(a) TYPE.—On the basis of host range (including families other than *Leguminosae*), symptoms and physical properties, this virus is classified as lucerne (alfalfa) mosaic virus. Weimer (22, 23).

(b) NECROTIC STRAIN.—This virus results in both local and systemic necrosis on bean, and it is therefore firstly compared with others causing a similar symptom.

(i) On some varieties of bean, both the bean Southern mosaic virus, Zaumeyer and Harter (26) and the bean pod mottle virus, Zaumeyer and Thomas (27) cause a local and systemic necrosis. However, both have very restricted host ranges, and the physical properties values differ considerably from those for this virus. Further the pod mottle virus causes a far more severe necrosis on bean.

(ii) The pea New Zealand streak virus, Chamberlain (3) differs in the type of necrosis on bean, pea and lupin, and causes only local lesions on the *Trifolium* species. The physical properties also differ.

(iii) There are several other viruses and strains of lucerne mosaic virus which result in both local and systemic necrosis on bean, but the differences in the type of necrosis and symptoms on other hosts are too great for closer comparisons to be made.

(iv) There is apparently a relationship with the lucerne (alfalfa) mosaic virus group, as the symptoms on many hosts and the physical properties are very similar.

However, this virus cannot be wholly identified with any previously described strain, and it is therefore named lucerne mosaic virus, NECROTIC strain.

(c) GLYCINE STRAIN.—There are many similarities between this virus and those in the lucerne mosaic virus group, in respect of symptom expression on several hosts and physical property values.

However, it differs from them in being non-infectious to the solanaceous plants, and the reaction of broad bean, soybean and pea etc. is different. Moreover, many species show a vivid yellow mottle instead of the usual chlorosis.

Relationship with the lucerne mosaic virus is probable and it is named the GLYCINE strain.

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FIG. 1.—ALSIKE CLOVER MOSAIC VIRUS 1.

A. *Crotalaria juncea*—natural infection. B. *C. juncea*—artificial infection.  
C. *Medicago lupulina*. D. *Pisum sativum*.



FIG. 2.—WHITE CLOVER MOSAIC VIRUS.  
A. *Vicia faba*. B. *Phaseolus vulgaris*. C. *Crotalaria spectabilis*.

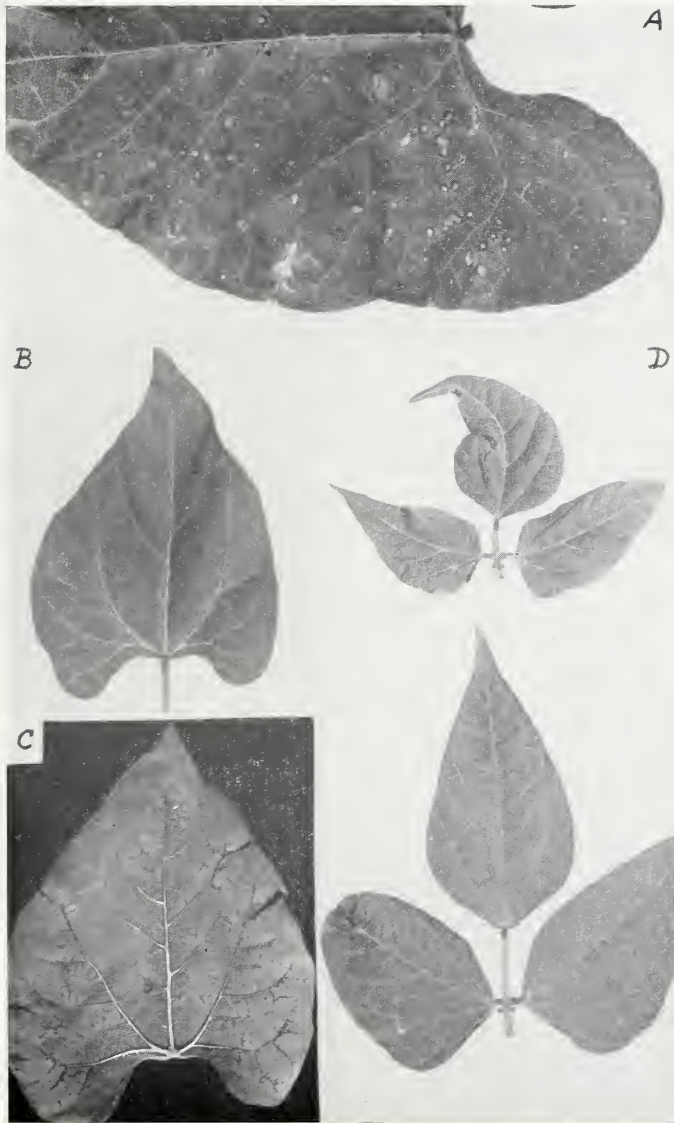


FIG. 3.—LUCERNE MOSAIC VIRUS STRAINS.

A-D. *Phaseolus vulgaris*—local lesions with A. TYPE virus. B. NECROTIC strain.  
C. GLYCINE strain. D. Systemic lesions with the NECROTIC strain.



FIG. 4.—LUCERNE MOSAIC VIRUS STRAINS.

A. *Vicia faba*. B. *Crotalaria juncea*. C. *Vigna unguiculata* with the TYPE virus.  
 D-E. *Trifolium incarnatum*. D. GLYCINE strain. E. TYPE virus. F. *Glycine max*  
 with the GLYCINE strain. G. *Lupinus albus* with the NECROTIC or GLYCINE strains.





FIG. 5.—LUCERNE MOSAIC VIRUS STRAINS.  
A. *Glycine javanica*—natural infection. B. *Nicotiana glutinosa*—local lesions.



# The Virus Diseases of Beans

by

Patricia J. Klesser

*Division of Plant Pathology*

In South Africa several types of bean are cultivated extensively—the runner, bush and haricot types being the most popular. Lima beans are grown on a small scale, but other *Phaseolus* species are rarely found. Apparently, no natural infections occur in the latter group.

The common bean mosaic has already been reported in this country (9); but, although various other disorders were known to be of virus origin, the causal organisms had not been identified.

Of the viroses described here, only bean mosaic and bean yellow mosaic are well known. The others are apparently new viruses or new variants of existing viruses.

An earnest attempt has been made to correlate these diseases with those already described, but with the information available this has not been possible, in all cases.

The differences in symptom expression may be due to the manifestation of known viruses on other varieties of test plants, or to climatic or environmental factors.

Many plant viruses occur in specific localities, and it is also possible that the diseases described here, are limited to this part of the continent.

A detailed account of each virosis is given here, in the hope that this will enable other workers to place them in the known plant virus classification.

## METHODS AND MATERIALS

Naturally infected plants were collected from many parts of the Union—notably Pretoria and district, Potchefstroom, the Northern Transvaal, Bethal and district and Stellenbosch.

Some sunnhemp plants were sent from Salisbury, Southern Rhodesia.

The standard test plants used were: *Phaseolus vulgaris* vars. Canadian Wonder and Haricot, *Pisum sativum* var. Greenfeast, *Vicia faba* vars. Aquedulce and Long Pod and *Vigna unguiculata* var. Dr. Saunder's Upright.

Many other legume species were also tested and some solanaceous plants.

Carborundum powder was used to facilitate sap inoculation, and *Aphis craccivora* was the insect vector in limited experiments.

Although some of the isolates used here came from species other than bean (e.g. sunnhemp and soybean) they are placed with the bean viruses. Some caused symptoms on bean, which closely resembled those of the bean isolates; while others resulted in symptoms on bean which were unusual, whereas on the original host, they were insignificant or similar to those caused by other viruses.

### 1. BEAN MOSAIC VIRUS Stewart and Reddick.

Physical properties: Thermal inactivation point 56–58 C.

Longevity *in vitro* 1–2 days.

Dilution end point 1:1000.

Transmission: Mechanical sap inoculation.

*Aphis craccivora*.

Seed—average of 25.3 per cent for eight varieties.

Host range: *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. vulgaris* L.

Occasionally, plants of the following species would show symptoms. These were checked by sub-inoculation to *Phaseolus vulgaris*.

*Pisum sativum* L., *Trifolium incarnatum* L., *Vicia faba* L., *Vigna unguiculata* (L.) Walp.

#### REACTION OF SUSCEPTIBLE SPECIES

##### *Phaseolus acutifolius*.

Local. There are chlorotic spots in seven days.

Systemic. The young leaves develop a vein-clearing or chlorotic speckling in 12 days, and they are curled. Later leaves are malformed and mottled with dark green blisters.

##### *P. lunatus*.

Local. Large chlorotic blotches develop.

Systemic. In three weeks the older leaves show chlorotic vein flecks and the young leaves a chlorotic network.

##### *P. vulgaris* var. Canadian Wonder.

Local. Usually there is no local reaction, but occasionally inoculated leaves show large chlorotic blotches some time after the young leaves show systemic symptoms, i.e. about three weeks after inoculation.

Systemic. Rarely do the first trifoliates show any symptoms. If so, there are small chlorotic spots. The second trifoliates curl down from the margins (inverse cupping) and are twisted. They may be slightly puckered and have a diffuse dark green mottle. Later formed leaves are lighter green with dark green puckered veinbands. The tips of these leaflets are long and narrow, and may be malformed. The plant is stunted.

##### *Plants grown from infected seed.*

Primary leaves have large dark green areas and the leaf surface may be rugose. There is a slight downward curl of the margins. Fig. 1A.

Trifoliolate leaves have varying degrees of inverse cupping and twisting, with broad dark green bands along the midrib of older leaves, and dark green mottling of the younger. Fig. 1B. Later formed leaves may show a clearing of the veins or small chlorotic spots. They may also be malformed and elongated. The plants are generally stunted.

The pods of some varieties show no symptoms, but most are mottled with slight depressions on the surface. The variety Rooikrans, if infected early, has pods with sunken red-brown necrotic areas. The virus is readily transmitted from these lesions.  
var. Haricot.

Local. No reaction.

Systemic. The older leaves are inversely cupped, rolled down or twisted. They have raised dark green areas. Later formed leaves have a dark green mottle or veinbanding and may also be curled down, with narrow tips.

##### *Plants grown from infected seed.*

The primary leaves have large irregular chlorotic areas, and the surface is uneven. The margins may be curled down. Fig. 2.

The trifoliolate leaves have a dark green veinbanding or mottle with raised areas. The young leaves are slightly smaller than normal and may be slightly puckered, and/or malformed. These have small chlorotic areas. The plant is stunted. Fig. 2.



The following varieties were also tested and found to be susceptible: Black Wonder, Idaho Refugee (Fig. 1D), Kentucky Wonder (Fig. 1E), Long Tom (Fig 1C), Refugee, S.A. Black and White, Tendergreen and Victor.

A survey was made of some experimental plots and the incidence of natural infection can be seen in Table 1.

*Pisum sativum.*

Local. No reaction.

Systemic. Some plants developed chlorotic veinbands and a mottle similar to those on the bean. On sub-inoculating to bean, typical symptoms were induced.

*Trifolium incarnatum.*

Local. No reaction.

Systemic. Some leaves show a diffuse veinbanding and they are rolled.

*Vicia faba.*

Local. No reaction.

Systemic. Some plants develop chlorotic blotches.

*Vigna unguiculata.*

Local. No reaction.

Systemic. There may be a chlorotic network followed by a diffuse chlorotic mottle on some varieties.

Natural source of virus: *Phaseolus vulgaris* vars. Canadian Wonder, Kentucky Wonder, Long Tom, Rooikrans and Haricot from Pretoria and district, Nylstroom, Bethal, Rustenburg and Potchefstroom.

### IDENTIFICATION.

From the characteristic symptoms on beans and the amount of seed transmission there can be little doubt that this is the common bean mosaic virus. (34, 42).

TABLE 1.—*Incidence of Bean Mosaic Virus in Field Plots*

Roodeplaat—March 1956

(a) *Bush Beans.*

<i>Name</i>	<i>Per cent Natural Infection</i>	<i>Name</i>	<i>Per cent Natural Infection</i>
Top Crop.....	2·0	Breustedts Pallas.....	75·0
Seminole.....	4·2	Long Tom.....	78·3
Refugee.....	5·0	Wachsbone.....	91·0
Idaho Refugee.....	9·5	Brytböna.....	98·0
Stamslabonen Voorluk	12·5	St. Andreas.....	98·0
Tendergreen.....	16·3	Saxa.....	99·0
Black Wonder.....	20·2	Burpees Stringless.....	100·0
Victory.....	38·0	Grandex.....	100·0
Streamliner.....	42·4	Heinrichs Riesen.....	100·0
Black Wax Pod.....	50·0	Kaiser Wilhelm.....	100·0
Wach's Express.....	57·0	Double White.....	100·0
Canadian Wonder....	57·0	Double Princess.....	100·0
Nordstern.....	69·0	Double Holland Princess	100·0
Wach's Breustedts....	70·0		

(b) *Runner Beans.*

As the runners were tangled on the trellises it was impossible to count the individual plants, so the percentage is only approximate.

<i>Name</i>	<i>Per cent Natural Infection</i>	<i>Name</i>	<i>Per cent Natural Infection</i>
Canfreezer.....	0·0	Gellman Runner.....	100·0
Green Savage.....	5·0	Wach's Goldbone.....	100·0
Everbearing.....	5·0	Mittelfrühe.....	100·0
Kentucky Wonder....	20·0	Phenomenon.....	100·0
Abundance.....	30·0	Meisterstück.....	100·0
Kapitan Weddingen...	80·0	Lazy Housewife.....	100·0

## 2.—BEAN MOSAIC VIRUS STRAIN

A second seed-borne virus was found on *Phaseolus vulgaris* var. Canadian Wonder which is used extensively in the insect proof glasshouses. In several batches of seed, about 12 per cent of the seedlings showed symptoms on the primary leaves immediately on unfolding. Conspicuous symptoms later developed on the trifoliate leaves. Fig. 3A.

The effect simulates a heritable abnormality, but positive sub-inoculations to many plant species disprove this possibility.

Physical properties: Thermal inactivation point 60–62°C.

Longevity *in vitro* 2–3 days.

Dilution end point 1:1000–1:5000.

Transmission: Mechanical sap inoculation.

Seed-borne approx. 12 per cent.

Not by *Aphis craccivora*.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Dolichos lablab* L., *Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., vars. sweet and bitter, *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *M. sativa* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

## REACTION OF SUSCEPTIBLE SPECIES

*Arachis hypogaea.*

Local. No reaction.

Systemic. After 14 days there are chlorotic spots on the young leaves. Later ones are chlorotic with dark green islands.

*Crotalaria juncea.*

Local. No reaction.

Systemic. There are chlorotic spots in 10 days and later leaves are mottled and slightly puckered.

*C. spectabilis.*

Local. No reaction.

Systemic. The young leaves develop a vein-clearing, and chlorotic spotting, and flecking. Later leaves are mottled with dark green veinbands, and they are crinkled.

*Dolichos lablab.*

A symptomless carrier.

*Glycine max.*

Local. Chlorotic stars develop in five days.

Systemic. The trifoliate leaves have isolated yellow areas which may cause a malformation.

*Lathyrus odoratus.*

Local. No reaction.

Systemic. A chlorotic spot mottling develops on most leaves.

*Lupinus albus* var. sweet.

Local. Necrotic specks develop.

Systemic. The young leaves remain folded and have a chlorotic network. Later leaves develop a mosaic and have wavy margins.

*L. albus* var. bitter.

Local. No reaction.

Systemic. Most leaves are chlorotic with dark green blisters. They are small and curled. The plant is rosetted.

*L. luteus.*

Local. No reaction.

Systemic. The leaves are mottled, elongated and malformed.

*L. mutabilis.*

Local. No reaction.

Systemic. The leaves are chlorotic with dark green blisters and necrotic specks. They are small and stringlike and the plant is rosetted.

*Medicago lupulina.*

Local. No reaction.

Systemic. After an initial spotting, later leaves develop a chlorotic streak mottle.

*M. sativa.*

Local. No reaction.

Systemic. There may be diffuse chlorotic spots.

*Melilotus officinalis.*

Local. No reaction.

Systemic. There are chlorotic streaks leaving dark green veinbands. The leaves are slightly puckered.

*Phaseolus acutifolius.*

Local. Chlorotic spots develop which later become necrotic.

Systemic. There is a chlorotic mottle with dark green blisters which result in an uneven leaf surface.

*P. lunatus.*

Local. There are chlorotic spots in five days.

Systemic. Most leaves develop chlorotic vein flecks with occasional chlorotic spots.

*P. mungo.*

Local. Chlorotic spots develop in five days.

Systemic. The young leaves have chlorotic specks.

*P. vulgaris* var. Canadian Wonder.

Local. There may be isolated chlorotic specks in five days.

Systemic. The young leaves are malformed and curl to one side. They develop an irregular chlorotic speck mottle or vein flecking. Some plants are stunted. Fig. 3B.  
var. Haricot.

Local. Small chlorotic spots may develop in five days.

Systemic. The leaves are crinkled, curled and malformed. They develop a chlorotic speck mottle.

*Pisum sativum.*

Local. No reaction.

Systemic. The young leaves develop a vein-clearing and chlorotic spotting in 10 days. Later leaves are mottled, and the plant is rosetted.

*Trifolium hybridum.*

Local. No reaction.

Systemic. A chlorotic streaking develops.

*T. incarnatum.*

Local. No reaction.

Systemic. The young leaves show a chlorotic network. Later leaves are chlorotic with dark green areas and also crinkled. The plant is stunted and rosetted.

*T. pratense.*

Local. No reaction.

Systemic. There is a chlorotic mottle leaving a dark green band along the midrib.

*T. repens.*

A symptomless carrier.

*Vicia faba.*

Local. Necrotic lesions develop, and the rest of the leaf becomes chlorotic.

Systemic. No reaction.

*Vigna sesquipedalis.*

Local. Chlorotic spots develop in five days.

Systemic. After a vein-clearing there is a chlorotic spot mottle.

*V. unguiculata.*

Local. There are chlorotic spots in five days.

Systemic. The young leaves develop a chlorotic network and later ones a chlorotic spotting.

*Voandzeia subterranea.*

Local. No reaction.

Systemic. After a chlorotic flecking on the young leaves, later ones develop mottle with necrotic specks.

Natural source of virus: *Phaseolus vulgaris*.

Canadian Wonder plants sown in an insect-free glasshouse. The primary leaves had chlorotic, almost white, specks, uniformly scattered over the leaf surface. The trifoliates were crinkled, slightly malformed and often curved to one side. There were areas of chlorotic speck mottling with varying amounts of necrosis in the chlorosis. The plants were severely stunted. Fig. 3A.

## IDENTIFICATION.

The symptoms caused by this virus on bean seem to resemble those described by Horsfall (17, 18) in a brief report on the one-sided mosaic—a strain of common bean mosaic virus. However, Zaunmeyer (51) working with a disorder similar to that found by Horsfall, attributed the symptom to a heritable abnormality.

When sap from the bean plants used in the experiments described here, was mechanically inoculated to several other legumes, obvious virus symptoms developed. Thus, it was concluded that in this case there was an infective organism involved and not a genetical mutation. Further tests proved that a virus was present.

Bean mosaic virus and its strains are known to be easily seed-transmissible, but there are also reports of the possible seed transmission of the red node virus, Thomas and Graham (46) and bean Southern mosaic virus, Zaunmeyer (55). Neither of the latter two viruses show further similarities with the one described here.

The type bean mosaic virus and most of its strains have very restricted host ranges, whereas with this virus, 26 species of *Leguminosae* are susceptible.



Snow (41) reported that a strain from gladiolus, which was 100 per cent seed-borne in beans, was able to infect several other legumes; but not broad bean, red, white or sweet clovers—all of which are hosts to this virus.

As this virus is also seed-transmissible it is provisionally placed with the bean mosaic virus group.

### 3.—BEAN CHLOROTIC RINGSPOT VIRUSES

Although none of these viruses originated from naturally infected *Phaseolus vulgaris*, the symptom expression on the bean is common to all forms described here. The local reaction consists of unusual, very marked chlorotic ring and line, or ringspot patterns, and the systemic symptom includes a mosaic and dark green blistering accompanied by a necrotic speckling.

The four isolates described here differ from one another on other host plants, but they are provisionally grouped together as strains of one virus, as their reactions on bean are identical.

Natural source of virus and locality:

Strain A.—*Crotalaria juncea*. Pretoria district and Groblersdal.

Strain B.—*Glycine max*. Pretoria and Bethal districts and Potchefstroom.

Strain C.—*Voandzeia subterranea*. Pretoria and district.

Strain D.—*Erythrina caffra*. Pretoria.

#### PHYSICAL PROPERTIES

	Thermal inactivation point° C.	Longevity <i>in</i> <i>vitro</i> —days.	Dilution end point.
Strain A.....	58–60	2–4	1:5000–1:10000
Strain B.....	56–58	2–3	1:1000–1:2000
Strain C.....	56–58	1–2	1:2000–1:5000
Strain D.....	60–62	1–2	1:1000–1:2000

Transmission: All are transmissible by mechanical sap inoculation. *Aphis craccivora* is not a vector.

Symptoms on naturally infected plants:

Strain A.—*Crotalaria juncea*. Most leaves had a mosaic mottle with dark green veinbands. They were also malformed and rolled. The older leaves had necrotic specks.

Strain B.—*Glycine max*. There were chlorotic specks, spots, veinbands or a mottle on the leaves, and they were slightly malformed and crinkled. The plants were rosetted and stunted.

Strain C.—*Voandzeia subterranea*. The leaves had a chlorotic mottle and the plants were rosetted.

Strain D.—*Erythrina caffra*. The young leaves were reduced in size and had chlorotic spots. Older leaves showed a chlorotic, almost yellow, mottle.

## HOST RANGES

Host Plant.	Strains.			
	A	B	C	D
<i>Arachis hypogaea</i> L.....		+	+	
<i>Crotalaria juncea</i> L.....	+	+		+
<i>C. spectabilis</i> Roth.....	+		+	+
<i>Dolichos lablab</i> L.....	+	-	+	+
<i>Glycine javanica</i> L.....	+		-	-
<i>G. max</i> (L.) Merr.....	+	+	+	+
<i>Lathyrus odoratus</i> L.....	+		+	+
<i>Lupinus albus</i> L.....		+	+	+
<i>L. luteus</i> L.....		+	+	+
<i>L. mutabilis</i> Sweet.....	+	+		+
<i>Medicago lupulina</i> L.....	+		+	+
<i>Melilotus officinalis</i> Willd.....	+	+	+	+
<i>Phaseolus acutifolius</i> Gray var. <i>latifolius</i> Freem.....		+	+	+
<i>P. lunatus</i> L.....	+	+	+	+
<i>P. mungo</i> L.....	+	+	+	+
<i>P. vulgaris</i> L.....		+	+	+
<i>Pisum sativum</i> L.....	+	+	+	
<i>Trifolium fragiferum</i> L.....				-
<i>T. hybridum</i> L.....	+		-	+
<i>T. incarnatum</i> L.....		+	+	+
<i>T. pratense</i> L.....	+	+	+	+
<i>T. repens</i> L.....	+			+
<i>Vicia faba</i> L.....	+	+	+	+
<i>Vigna sesquipedalis</i> (L.) Wight.....		+	+	+
<i>V. unguiculata</i> (L.) Walp.....	+	+	+	+
<i>Voandzeia subterranea</i> Thouars.....	+	+	+	+

## REACTION OF SUSCEPTIBLE SPECIES

Not all host plants were inoculated with all four strains, but available results are tabulated below. The letters A-D indicate the strains used.

*Arachis hypogaea*. B.C.

Local. B.C. No reaction.

Systemic. B.C. The leaves are chlorotic with dark green islands or veinbands

*Crotalaria juncea*. A-D.

Local. B. There are chlorotic spots in 10 days.

C.D. Necrotic spots or rings develop.

A. A combination of the above, viz., chlorotic spots which later become necrotic.

Systemic. A. After a chlorotic spotting of the young leaves later ones are mottled with dark green blisters. They are also malformed and almost stringlike. The old leaves have necrotic specks. The plant is stunted.

C. There is less malformation than with A but more necrosis—some plants may collapse.

B. D. There is a vein-clearing and chlorotic spotting followed by a mottle with dark green veinbands or concentric chlorotic patterns. Fig. 5A. With D the leaves have wavy margins and may be slightly malformed.

*C. spectabilis*. A-D.

Local. A. D. No reaction.

B. C. There are isolated necrotic lesions.

Systemic. All show a vein-clearing followed by a mottle with dark green islands, veinbands or blisters. Fig. 5B. With A-C the leaves are also crinkled and rolled; and the plant is rosetted with A.

*Dolichos lablab.* A. C. D.

A symptomless carrier for the three strains.

*Glycine javanica.* A.

Local. There are chlorotic spots in six days.

Systemic. A diffuse chlorotic spotting develops.

*G. max.* A-D.

Local. C. No reaction.

A. B. There are chlorotic specks or ring and line patterns.

D. A slight veinal necrosis develops.

Systemic. C. D. The leaves have chlorotic patterns and irregular dark green areas. They are also crinkled. Fig. 5H.

A. B. In addition there are necrotic specks, Fig. 5I, and with A the plant is stunted and rosetted.

*Lathyrus odoratus.* A. C. D.

Local. None show a reaction.

Systemic. A. D. The leaves are mottled with dark green veinbands, and rolled or cupped.

C. There are chlorotic streaks along the veins and the leaves are malformed.

*Lupinus albus.* A-D.

Local. C. No reaction.

D. There are first chlorotic spots, but later the leaves are uniformly chlorotic.

A. There are chlorotic spots which later become necrotic and the leaves drop.

B. The chlorotic spots have a necrotic speck in the centre.

Systemic. D. The leaves develop a mosaic and the plant is slightly stunted.

B. C. As well as a mosaic, the leaves have dark green blisters and they are small and malformed. With B many leaves drop, leaving an almost bare stem and petioles.

A. In addition there are necrotic specks on the leaves and the plant is severely stunted.

*L. luteus.* A-D.

Local. C. D. No reaction.

A. B. Chlorotic spots develop.

Systemic. C. D. The young leaves remain folded and have wavy margins. Later formed leaves are mottled, and malformed or elongated. The plant is stunted.

A. B. In addition there are necrotic specks.

*L. mutabilis.* A. B. D.

Local. No reaction.

Systemic. With all three strains the leaves are mottled, malformed and reduced in size. The plant is rosetted.

*Medicago lupulina.* A. C. D.

Local. No reaction.

Systemic. A. C. After a vein-clearing there is a mottle with chlorotic streaks. The leaves are crinkled.

D. A symptomless carrier.

*Melilotus officinalis.* A-D.

Local. A-C. No reaction.

D. There are chlorotic spots.

Systemic. B-D. The leaves are mottled and crinkled.

A. There is a chlorotic ring spotting on the young leaves, and streaking on later ones, which are also small and malformed. Fig. 5F.

*Phaseolus acutifolius.* A-D.

Local. A. Chlorotic spots and veins develop.

B. C. D. There are necrotic lesions and veins plus chlorotic spots. These leaves usually collapse.

With C. there is also a marked epinasty.

Systemic. A. The young leaves curl back and have chlorotic veins and spots. Later leaves have an almost white speck mottling.

C. In addition to the above mottle there are dark green blisters. The pods are also mottled.

B. C. D. The young leaves curl back and develop a chlorotic network or patterns which become necrotic. Fig. 5D. This results in a collapse of plants inoculated with D. Should secondary shoots develop they have malformed, mottled leaves.

*P. lunatus*. A-D.

Local. D. No reaction.

B. Large chlorotic blotches develop.

A. C. There are chlorotic spots or ringspots which with C. become necrotic later. Fig. 5E.

Systemic. With all strains there is a chlorotic network or vein flecking. With A and D this is accompanied by a necrosis in the chlorosis.

*P. mungo*. A-D.

Local. C. No reaction.

D. Chlorotic spots develop.

A. B. There are necrotic spots and veins.

Systemic. A-C. There is a chlorotic spotting.

D. Only a diffuse mottle develops.

*P. vulgaris*. A-D.

(a) var. Canadian Wonder.

Local. All induce chlorotic ringspots, ring and line patterns or a vein etching. Fig. 4A.

Systemic. The young leaves develop a vein-clearing and chlorotic spots, Fig. 4D., and the leaves curl down. On some newly formed leaves there are yellow specks or distinct rings Fig. 4E., but later there is a mottle. The leaves are crinkled and have many small necrotic specks. Fig. 4C.

With D. the pods are mottled and with C. they are malformed and have necrotic rings. Fig. 5G.

(b) var. Haricot.

Local. All strains result in chlorotic ringspots, or ring and line patterns. Fig. 4B. Systemic. After an initial vein-clearing and chlorotic spotting the next formed leaves are mottled with dark green blisters, and they are malformed. The plants are rosetted.

With A. there is also a necrotic speckling which may cause a collapse of the plant.

(c) vars. Black Wonder, S.A. Black and White, Long Tom and Victor develop symptoms similar to Canadian Wonder.

(d) vars. Tendergreen and Idaho Refugee do not produce a distinct local reaction, but the systemic symptoms are similar to those on Canadian Wonder.

*Pisum sativum*. A-D.

Local. B. C. No reaction.

A. Chlorotic specks develop and the leaves drop.

Systemic. B. C. Some leaves are mottled, while others have chlorotic areas which lead to a constriction of the laminae. The plants are rosetted and stunted.

A. The young leaves remain folded and have a chlorotic network and spotting. Later formed leaves develop a mosaic, while the old leaves have a white vein etching. The plant is rosetted and the tendrils are abnormally curled.

D. A symptomless carrier.

*Trifolium hybridum*. A. B. D.

Local. No reaction.



Systemic. All three strains cause chlorotic spots or streaks and occasionally a mottle.

A. can be latent on this host.

*T. incarnatum*. A-D.

Local. A. B. C. No reaction.

D. There is a chlorotic vein etching and spotting.

Systemic. A. B. C. After a veinclearing there is a mottle with dark green veinbands, and the leaves are crinkled.

D. In addition the older leaves develop chlorotic spots with necrotic rings.

*T. pratense*. A-D.

Local. No reaction.

Systemic. B. C. D. There are chlorotic spots, streaks or blotches. With C there are also yellow concentric patterns on the older leaves.

A. A symptomless carrier.

*T. repens*. A. D.

A symptomless carrier with both strains.

*Vicia faba*. A-D.

Local. D. No reaction.

A. Necrotic lesions develop.

B. There are purple necrotic rings and the remaining tissue becomes yellow.

Systemic. D. Diffuse chlorotic spots develop.

A. There is a chlorotic spotting with a necrotic network.

B. C. No symptoms but the virus can be recovered.

*Vigna sesquipedalis*. A-D.

Local. D. No reaction.

A. There are chlorotic spots but later the whole leaf becomes chlorotic.

B. There are necrotic lesions and the rest of the leaf becomes chlorotic. They soon abscise.

C. In addition to the symptoms with B there is a marked epinasty.

Systemic. All induce a veinclearing, chlorotic spotting and mottle. B. may cause a stunting of the plants.

*V. unguiculata*. A-D.

Local. D. No reaction.

A. After a chlorotic spotting the leaves become flaccid.

B. There are necrotic lesions and the remaining leaf tissue becomes yellow. The leaves soon drop.

C. There is a marked epinasty as well.

Systemic. B. C. D. Chlorotic spots develop and later a mottle.

A. In addition there are dark green blisters with the mottle, and later a necrotic sheen. The leaves are malformed and there may be necrotic stem streaks.

*Voandzeia subterranea*. A-D.

Local. Only with C are there chlorotic blotches.

Systemic. With all strains there may be a veinclearing, mottle and crinkle. Fig. 5C. Some plants with A and D are symptomless carriers.

## IDENTIFICATION.

The characteristic feature of this group of viruses is the well-defined chlorotic ring and line or ringspot reaction on the inoculated leaves of bean. Similar symptoms on some varieties of bean are described by Cheo and Zaumeyer (8) with their strain of tobacco ringspot virus from bean, and with the green strain of tobacco ringspot.

However, none of the four isolates recorded here can be fully identified with either of these strains. There may be similarities in symptom expression on several hosts,

e.g. on *Glycine max* the D isolate resembles the bean strain of Cheo and Zaumeyer, and on white lupin the A isolate is similar to the green strain, but on other plants there are considerable differences.

Further, *Dolichos lablab* which is used as a differential host by Cheo and Zaumeyer when comparing four strains of tobacco ringspot virus, is a symptomless carrier for three of the isolates described here, viz. A, C, D. and is not susceptible to the fourth.

On cowpea, the bean strain induces a systemic necrosis, which does not occur with any of these strains; and on broad bean it causes systemic necrotic rings which are not present with any of these isolates.

The type tobacco ringspot virus on bean usually induces local necrotic spots, rings or veins followed by systemic necrosis and collapse, Pierce (29) and Price (32). The effect of the viruses described here is mainly chlorotic with only necrotic specks on the trifoliate.

Stubbs (43) described the symptoms of the type virus on peas, which is also necrotic, whereas with these strains it is only chlorotic.

In addition, the host ranges differ considerably.

Although there can be little doubt that the viruses recorded here are related to the tobacco ringspot group, there is no complete correlation with any of the strains previously described. They are therefore reported as additional strains and named bean chlorotic ringspot viruses A, B, C and D.

#### 4.—BEAN LOCAL CHLOROSIS VIRUSES

The characteristic feature of the viruses in this group is the local reaction on the bean, viz. a distinct chlorotic spotting. This reaction occurred with isolates from several plant species. In other details these seven isolates differ from one another. They are therefore not considered to be one virus, but strains of the virus linked by their common local reaction on the bean. (Only strains F and G differ slightly in the systemic reaction on bean.)

Natural source of virus and locality:

Strain A.—*Medicago denticulata*. Stellenbosch.

B.—*Lathyrus odoratus*. Pretoria and district.

C.—*Phaseolus vulgaris*. Rustenburg.

D.—*Crotalaria juncea*. Salisbury.

E.—*Glycine max*. Pretoria, Nylstroom, Potchefstroom.

F.—*Phaseolus vulgaris*. Pretoria district.

G.—*Trifolium incarnatum*. Stellenbosch.

#### PHYSICAL PROPERTIES

Virus.	Thermal inactivation point °C.	Longevity <i>in vitro</i> —days.	Dilution end point.
Strain A.....	60-62	2-3	1:2,000-1:5,000
Strain B.....	58-60	2-3	1:1,000-1:2,000
Strain C.....	58-60	1-2	1:1,000-1:2,000
Strain D.....	62-65	1-2	1:2,000-1:5,000
Strain E.....	56-58	1-2	1:1,000-1:2,000
Strain F.....	60-62	3-4	1:2,000-1:5,000
Strain G.....	56-58	1-2	1:2,000-1:5,000

Transmission: All are transmissible both by mechanical sap inoculation and by *Aphis craccivora*.

Symptoms on naturally infected plants (i.e. source of virus).

Strain A.—*Medicago denticulata*. The leaves showed varying degrees of chlorosis—spots, streaks, mottle and mosaic. They were small and crinkled and the plants were stunted. The incidence of infection was high.

Strain B.—*Lathyrus odoratus*. The leaves had chlorotic streaks or veinbands and they were small and puckered.

Strain C.—*Phaseolus vulgaris* var. Black Wonder. Most leaves were puckered and had small chlorotic specks. The plants were slightly stunted.

Strain D.—*Crotalaria juncea*. Some leaves had chlorotic spots, but most showed a mosaic, with dark green veinbands. They were also slightly malformed and rosetted; and the plants were stunted.

Strain E.—*Glycine max*. The leaves were mottled and puckered, and the plants were slightly stunted with a proliferation of the lateral shoots.

Strain F.—*Phaseolus vulgaris* (a) var. Long Tom. The leaves were mottled and severely curled and malformed. There were occasional necrotic stem streaks, and the pods had marked necrotic lesions. (b) var. Haricot. The young leaves had a chlorotic network and were curled. Older ones were crinkled and mottled with dark green blisters.

Strain G.—*Trifolium incarnatum*. The leaves showed irregular chlorosis and they were small, crinkled and malformed. The plants were severely stunted.

#### HOST RANGES.

Host Plant.	Strains.						
	A	B	C	D	E	F	G
<i>Arachis hypogaea</i> L.....	+	—			+		+
<i>Crotalaria juncea</i> L.....	—		+	+		+	+
<i>C. spectabilis</i> Roth.....	+	+	+	+		+	+
<i>Dolichos lablab</i> L.....	+		+	+	—		
<i>Glycine javanica</i> L.....	+		+	+		+	+
<i>G. max</i> (L.) Merr.....		+	+	+	+		+
<i>Lathyrus odoratus</i> L.....	+	+	+	+		+	+
<i>Lupinus albus</i> L.....	+	+	+	+	+	+	+
<i>L. luteus</i> L.....		+	+	+	+	+	+
<i>L. mutabilis</i> Sweet.....	+		+	+			+
<i>Medicago denticulata</i> L.....	+						
<i>M. lupulina</i> L.....	+	—	+	+		+	+
<i>Melilotus officinalis</i> Willd.....	+	—	+	+		+	+
<i>Phaseolus acutifolius</i> Gray var. <i>latifolius</i> Freem..	+		+	+	+	+	+
<i>P. lunatus</i> L.....	+	—	+	+	+	+	+
<i>P. unguis</i> L.....	+	+	+	+	+	+	+
<i>P. vulgaris</i> L.....	+	+	+	+	+	+	+
<i>Pisum sativum</i> L.....	+	+	+	+	+	+	+
<i>Trifolium fragiferum</i> L.....	—		—			+	—
<i>T. hybridum</i> L.....	+	+	+	+	+		+
<i>T. incarnatum</i> L.....	+	+	+	+	+	+	+
<i>T. pratense</i> L.....	+	—		+		+	+
<i>T. repens</i> L.....	—		—	—		+	+
<i>Vicia faba</i> L.....	+	+	+	+	+	+	+
<i>Vigna sesquipedalis</i> (L.) Wight.....	+			+	+	+	+
<i>V. unguiculata</i> (L.) Walp.....	+	+	+	+	+	+	+
<i>Voandzeia subterranea</i> Thouars.....	+	—	+	+		+	+

## REACTION OF SUSCEPTIBLE SPECIES

Not all strains were tested on every host plant, but the available results are compared below. The letters, A-G indicate the strains.

*Arachis hypogaea.* A. E. G.

Local. No reaction.

Systemic. A. The young leaves develop a mottle with a dark green midrib.

E. Chlorotic spots develop on the young leaves in 14 days. Later leaves are chlorotic with dark green islands.

G. There is a chlorotic mottle on most leaves.

*Crotalaria juncea.* A. C. D. F. G.

Local. A. C. G. No reaction.

D. Chlorotic spots develop in eight days.

F. In seven days large necrotic lesions develop which fuse later to give a "scorch" effect.

Systemic. A. G. After a vein-clearing of the young leaves, the next formed are mottled with dark green blisters. They are also crinkled and curled and the plant is stunted.

C. In addition to the above there is a severe malformation and some leaves are almost stringlike. Fig. 6A.

D. F. Similar to C. with necrotic specks. With F, also a vascular necrosis which results in the death of the plant.

*Crotalaria spectabilis.* A. B. C. D. F. G.

Local. Only with D are there small chlorotic spots.

Systemic. A. D. The young leaves develop a chlorotic network and speckling. The next leaves are crinkled with wavy margins, and are chlorotic with irregular dark green islands.

C. F. After a vein-clearing the leaves develop dark green veinbands.

B. The new leaves have conspicuous white streaks which result in a malformation. (See report on sweet pea virus diseases for photograph.)

G. There is a mild speck mottling.

*Dolichos lablab.*

A symptomless carrier for A. C. D.

*Glycine javanica.* A. C. D. F. G.

F. G. Symptomless carriers.

Local. A. D. Chlorotic spots develop in 4-5 days.

C. No reaction.

Systemic. A. D. A diffuse mottle develops.

C. A chlorotic spotting is followed by chlorotic streaks.

*Glycine max.* B-G.

Local. B. C. D. No reaction.

G. There is a general chlorosis.

E. F. Chlorotic stars, rings and spots develop. With F, there are also necrotic specks.

Systemic. B. C. Only a diffuse mottle develops.

D. After a chlorotic spotting, there is a mottle of the leaves which are crinkled.

G. There may be chlorotic spots with necrotic rings on the older leaves, while the younger ones are mottled.

E. F. There is first a vein-clearing, then chlorotic spotting and a mottle. Later, necrotic specks develop. The leaves are crinkled and the plants are stunted.

*Lathyrus odoratus.* A. B. C. D. F. G.

Local. No reaction.

Systemic. C. There is only a diffuse mottle.

F. The leaves are elongated and rolled and show chlorotic streaks.



A. D. G. The early symptoms are similar to F, but later formed leaves have a mottle with well-defined dark green veinbands.

B. There is a mosaic mottle on most leaves and the stems show necrotic streaks. (See report on the virus diseases of sweet pea.)

*Lupinus albus*. A-G.

Local. A. B. C. No reaction.

D. F. There are small necrotic specks.

E. After the necrotic specks have developed, the leaves become chlorotic and soon drop.

Systemic. A. After a chlorotic spotting of the young leaves, there are dark green blisters on later formed leaves which are reduced in size. The plant is stunted.

C. E. There is an initial mosaic but later leaves are quite chlorotic. They are small, have wavy margins and remain folded. Many absciss.

B. D. G. In addition to the symptoms for C. E. there are necrotic specks on the leaves; and necrotic stem streaks with D.

*Lupinus luteus*. A-G.

Local. A. B. C. F. G. No reaction.

D. Chlorotic spots develop.

E. The leaves are chlorotic with necrotic specks and they soon drop.

Systemic. A. B. The leaves are mottled and crinkled and they remain folded.

C. E. G. There is also a malformation of the leaves and the plant is stunted.

D. F. The malformation is severe and the leaves are stringlike with dark green blisters.

With F. there are also necrotic stem streaks.

*Lupinus mutabilis*. A. C. D. G.

Local. No reaction.

Systemic. A. D. The leaves are chlorotic with dark green blisters, and they are malformed. The plant is rosetted.

C. G. The plants collapse after necrosis.

*Medicago lupulina*. A. C. D. F. G.

Local. Only with F is there a reaction. Necrotic lesions develop, and fuse, and the leaves collapse.

Systemic. The symptoms are similar for all strains, viz. a chlorotic streak mottle and/or dark green veinbands. With D the leaves are crinkled.

*Melilotus officinalis*. A. C. D. F. G.

Local. A. C. G. No reaction.

D. F. There are chlorotic spots with dark green rings.

Systemic. C. D. A chlorotic spot mottling develops.

A. In addition the leaves are malformed.

F. G. There are distinct ring and line patterns and the leaves are malformed.

With F there may also be necrotic specks.

*Phaseolus acutifolius*. A. C. D. E. F. G.

Local. All these strains induce a chlorotic and necrotic reaction—usually chlorotic spots with necrotic veins. C and E also induce necrotic spots and G also causes necrotic rings round the chlorotic spots.

Systemic. A. C. F. After a veinclearing there is a mottle with slight malformation.

D. E. G. In addition there is a necrosis of the veins; or necrotic specks with G.

*P. lunatus*. A. C. D. E. F. G.

Local. Except for D, these strains induce chlorotic spots or large blotches. D shows no reaction.

Systemic. D. After a veinal necrosis the leaves drop.

The other strains cause a chlorotic vein flecking.

*P. mungo*. A. C. D. E. F. G.

Local. A. D. There are chlorotic spots.

F. There are necrotic spots.

E. G. There are both chlorotic spots and necrotic specks or veins.

Systemic. A. E. After a veinclearing there are chlorotic spots or irregular areas.

D. F. G. In addition, necrosis sets in, in the chlorosis and the leaves have a necrotic sheen.

C is latent in this plant.

*P. vulgaris* var. Canadian Wonder. A-G.

Local. All strains cause distinct, vivid chlorotic spots. Fig. 6C. These may fuse with closely adjacent ones, Fig. 6D, but usually they retain their individuality.

Systemic. A-E. After a clearing of the veins there is a chlorotic spotting and then a mottle.

With D and E there are also dark green veinbands.

F. G. In addition the young leaves develop necrotic specks and they are malformed. The pods have sunken dark green areas and they are misshapen.

vars. Black Wonder, Idaho Refugee, Long Tom, S.A. Black and White.

Tendergreen and Victor show symptoms similar to those on Canadian Wonder.

var. Haricot may develop local chlorotic specks with strains A. D. E. F., but, on the trifoliate leaves the reaction is the same as that on Canadian Wonder.

*Pisum sativum*. A-G.

Local. B. C. E. G. No reaction.

A. F. After a veinal necrosis the leaves collapse.

D. There may be chlorotic specks.

Systemic. A. B. F. After a veinclearing and chlorotic spotting there is a mottle on later formed leaves. Necrosis sets in, in the chlorosis, or there are necrotic stem streaks and the plant collapses.

C. G. There is a veinclearing, chlorotic spotting and mottle, and the plants are rosetted.

D. E. In addition to the mottle, the leaves are malformed and small, and the tendrils are abnormally curled. The older leaves have an almost white vein etching.

*Trifolium fragiferum*. F.

Local. Necrotic spots develop after six days.

Systemic. A. Diffuse chlorotic (almost white) spotting occurs.

*T. hybridum*. A-G.

Local. A. C. D. E. G. No reaction.

B. F. There is a chlorotic spotting.

Systemic. A. B. C. G. Chlorotic streaks following the veins develop.

D. F. There is a chlorotic spotting on the young leaves, and on later formed ones there is a vivid yellow streak mosaic. With D the plants are also stunted.

E. A symptomless carrier.

*T. incarnatum*. A-G.

Local. B. C. E. F. No reaction.

A. D. Chlorotic spots develop in 5-6 days.

G. There are chlorotic streaks with necrotic rings and necrotic centres.

Systemic. B. C. E. After a veinclearing there is a mosaic mottle, and slight puckering of the leaves.

D. G. There is a chlorotic network, followed by a chlorotic spotting and later a mosaic. The leaves are crinkled and malformed, and the plant is rosetted and stunted.

F. In addition to the symptoms for D and G, necrosis sets in, in the chlorotic spots.

A. After 10 days the young leaves show a veinclearing. Later formed leaves have a mosaic with dark green veinbands and blisters. They are severely crinkled, with wavy margins. The plant is extremely stunted and rosetted, and may collapse.

*T. pratense*. A. D. F. G.

Local. A. D. F. G. No reaction.

Systemic. A. In 10 days the veins are chlorotic, and later a mosaic develops. The leaves are crinkled and may be malformed with necrotic areas.

D. F. There is a chlorotic streak mottle, but D may be latent in this host.

G. After a vein-clearing there are short dark green veinbands and a dark green midrib. The leaves are crinkled or slightly malformed.

*T. repens*. F. G.

A symptomless carrier for both strains.

*Vicia faba*. A-G.

Local. B. C. No reaction.

A. There are chlorotic spots with small necrotic specks in four days.

D. Small necrotic lesions develop.

F. In 4-5 days there are large necrotic lesions which spread and fuse with adjacent ones. As the leaves mature, the background becomes yellow. Fig. 6B.

Systemic. A. B. C. D. There is a chlorotic network and spotting, with a mottle on later formed leaves.

F. Occasionally the local necrosis will spread down the petiole and thence into the stem. This results in the collapse of the plant.

E. G. Symptomless carrier.

*Vigna sesquipedalis*. A. D. E. F. G.

Local. A. E. F. G. Chlorotic spots develop in 5-6 days.

D. There are first chlorotic ringspots, but later the whole leaf becomes chlorotic.

Systemic. A. No reaction.

D. E. F. G. There are chlorotic spots and later a mottle.

*V. unguiculata*. A-G.

Local. D. No reaction.

A. B. C. E. G. There are necrotic lesions in 4-5 days.

F. Although there is no necrosis, the leaves become flaccid and abscise.

Systemic. B. No reaction.

A. C. E. F. G. After a vein-clearing there are chlorotic specks, and, on later formed leaves, a mottle.

D. The mottle is accompanied by dark green blisters.

*Voandzeia subterranea*. A. C. D. F. G.

Local. A. C. F. G. No reaction.

D. There are chlorotic spots with necrotic rings in seven days.

Systemic. All induce a chlorotic spotting followed by a mottle. In addition, D causes dark green veinbands.

## IDENTIFICATION.

The feature which links these seven strains is the vivid chlorotic spotting on the inoculated leaves of the bean.

A similar symptom has been described by Ainsworth with the "sweet pea streak" virus (1), Zaumeyer with alfalfa yellow mosaic virus (53) and Smith and Markham with a virus from *Ligusticum* (40). Van der Want (50) reports that on the variety Servus, local chlorotic spots are sometimes produced with two strains of bean yellow mosaic virus.

However, although there may be other similarities between these four viruses and some of the strains described here, there is no complete correlation, e.g. strain G resembles alfalfa yellow mosaic in its reaction on bean, pea and broad bean, but on other hosts it differs considerably. Further, the alfalfa yellow mosaic can infect solanaceous plants, whereas the host range of this virus is restricted to the *Leguminosae*.

During a survey of legume virus diseases in England (22) three strains causing this characteristic local reaction on bean were isolated from naturally infected species of *Phaseolus*, *Pisum*, *Vicia*, *Trifolium*, *Medicago*, *Melilotus* and *Lathyrus*. These strains

were designated A. B. and C. and they have also been found in this country on *Phaseolus*, *Lathyrus* and *Medicago* spp. A further four strains have been isolated from other naturally infected host plants, viz. *Crotalaria*, *Glycine*, *Phaseolus* and *Trifolium* spp. and are named bean local chlorosis virus, strains D. E. F. and G.

## 5. BEAN NECROSIS VIRUS

A virus found on naturally infected *Crotalaria spectabilis* caused extremely severe local and systemic necrosis on bean. A similar reaction on bean developed with isolates from *Dolichos lablab* and *Glycine javanica*, but on some other host plants these isolates differed.

In this account the virus is described as a whole, and the variations are given under the appropriate species.

Physical properties: Thermal inactivation point 65–70°C.  
Longevity *in vitro* 6–7 days.  
Dilution end point 1:5,000–1:10,000.

Transmission: Mechanical sap inoculation.  
Not by *Aphis craccivora*.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth., *Dolichos lablab* L., *Glycine javanica* L., *G. max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

### REACTION OF SUSCEPTIBLE SPECIES

#### *Arachis hypogaea*.

Local. No reaction.

Systemic. The leaves have chlorotic areas with dark green islands.

#### *Crotalaria juncea*.

Local. There are necrotic lesions and the leaves drop.

Systemic. After 12 to 14 days there is a vein clearing of the young leaves, followed by a chlorotic spotting and a mottle mosaic. The leaves are rolled and the plant is stunted.

#### *C. spectabilis*.

Local. No reaction.

Systemic. After a vein-clearing and spotting of the young leaves, later ones are very chlorotic and rolled and crinkled. The plant is stunted.

#### *Dolichos lablab*.

Local. No reaction.

Systemic. The young leaves develop a chlorotic network. The next formed leaves are mottled and slightly crinkled.

#### *Glycine javanica*.

Local. There are small necrotic specks and the leaf becomes chlorotic.

Systemic. Chlorotic spots and vein flecks develop on most leaves. On some there are large irregular chlorotic blotches, and the leaves are puckered.

#### *Glycine max*.

Local. Small necrotic specks appear in 10 days.

Systemic. The young leaves develop chlorotic veins, spots and flecks. Necrosis develops in the chlorosis of the old leaves, resulting in a malformation. The plant is stunted.



*Lathyrus odoratus.*

Local. No reaction.

Systemic. Most leaves show a dark green streak mottle and they are rolled downwards.

*Lupinus albus.*

Local. There are chlorotic spots.

Systemic. In 11 to 12 days the young leaves develop a veinclearing with chlorotic spots. Later leaves are small and malformed with dark green blisters. They remain folded and the margins are irregular. The growing point is rosetted and the plant is stunted. Many older leaves drop.

*L. luteus.*

Local. Small chlorotic spots may develop.

Systemic. A veinclearing and chlorotic spotting of the young leaves develops in eight to nine days. New leaves remain folded with the tips twisted. They are mottled and small. The plant is stunted.

*L. mutabilis.*

Local. No reaction.

Systemic. The young leaves curl up, and they are spotted. Later ones are very small and chlorotic. Many drop.

*Medicago lupulina.*

A symptomless carrier.

*Melilotus officinalis.*

Local. No reaction.

Systemic. Occasional irregular vivid chlorotic areas and some dark green ringspots develop. Fig. 7B. The virus is recoverable from symptomless leaves.

*Phaseolus acutifolius.*

Local. There may be necrotic specks.

Systemic. The young leaves curl back and have veins which are chlorotic then necrotic. The plant collapses.

*P. lunatus.*

Local. Small necrotic lesions appear in four days. These have chlorotic haloes.

Systemic. There are chlorotic vein flecks on most leaves in three weeks. Fig. 7C.

*P. mungo.*

Local. In five days there are necrotic rings.

Systemic. There is a chlorotic spotting and then a mosaic with a slight distortion.

*P. mungo* with the B isolate.

A symptomless carrier.

*P. vulgaris* var. Canadian Wonder.

Local. There is a severe necrosis of the veins and petioles. Fig. 7E.

Systemic. In 12 days the young leaves start to curl round and back, and have a veinclearing. Necrosis sets in, in the veins causing a malformation. These leaves drop and very few more are formed. Fig. 7A. The old leaves have large chlorotic blotches.

## var. Haricot.

Local. In seven to eight days the leaves have necrotic veins.

Systemic. This necrosis spreads along the petioles and up the stem. The young leaves show a necrotic sheen and the growing point collapses in 14 to 15 days.

*Pisum sativum.*

Local. The leaves collapse after a general necrosis.

Systemic. In eight to nine days a veinclearing of the young leaves develops. Later leaves have a mottle or mosaic with necrosis. The growing point is rosetted and the plant is stunted and may collapse.

*P. sativum.* With the B isolate.

Local. No reaction.

Systemic. Only a chlorotic network of the young leaves develops in 13 days.  
*Trifolium hybridum*.

Local. No reaction.

Systemic. After a chlorotic spotting on the young leaves, the next show alternate streaks. Necrosis sets in, in the chlorosis. Fig. 7D.

The B isolate is latent.

*T. incarnatum*.

Local. There are necrotic veins on chlorotic leaves.

Systemic. In a week the young leaves show a chlorotic network, and vein flecks. Later leaves have a mosaic with dark green veinbands and they are crinkled. The plant is very stunted and usually collapses.

The B isolate is latent.

*T. pratense*.

Local. No reaction.

Systemic. There are diffuse dark green veinbands.

*Vicia faba*.

Local. There are necrotic rings on chlorotic leaves.

Systemic. After 10 days the young leaves show a chlorotic network with small chlorotic spots. Later leaves are mottled.

*Vigna sesquipedalis*.

Local. No reaction.

Systemic. The young leaves develop chlorotic spots and flecks, and later veinbands.

*V. unguiculata*.

Local. In five days the leaves show necrotic spots and they drop.

Systemic. Only a diffuse mosaic develops on the young leaves of some varieties. The virus is recoverable from symptomless plants.

*Voandzeia subterranea*.

A symptomless carrier.

Natural source of virus:

- (a) *Crotalaria spectabilis*. Potchefstroom, Pretoria and district. There was a chlorotic mottle with dark green veinbands and blisters. On older leaves there was necrosis in the chlorosis, and there were also necrotic stem streaks. The plants were stunted and rosetted.
- (b) *Dolichos lablab*. Prinshof Experimental Station, Pretoria. The younger leaves had chlorotic spots; and the older ones, a mottle with dark green veinbands and blisters.
- (c) *Glycine javanica*. An experimental plot adjacent to (b). There were irregular chlorotic areas on most leaves, which were also puckered.

## IDENTIFICATION.

The dominant feature of this virus is the severe local and systemic necrosis on bean. This type of symptom occurs with many other viruses, with which this one will be compared:—

- (a) The reaction appears to be very similar to photographs of black root, Jenkins (19, 20) which is the symptom expression of common bean mosaic virus on particular variety lines of bean. However, as Canadian Wonder has been used throughout these experiments, and has shown the more typical reaction of bean mosaic (veinbanding, rolling etc.) that virus is not the causal agent. This is further confirmed by the great differences in host range and physical properties.

- (b) There are several strains of alfalfa mosaic virus which may result in similar symptoms on some varieties of bean, e.g. the tuber necrosis and potato calico strains of Oswald (26), alfalfa mosaic N of McWhorter (23) and alfalfa yellow mosaic virus of Zaumeyer (53). However, on other hosts the symptoms differ considerably from those caused by this virus, and, with the first three-named strains, the property values differ also.
- (c) Of the several bean yellow mosaic virus strains, only the X-strain of McWhorter (24) and the severe yellow strain of Thomas and Zaumeyer (49) induce both local and systemic necrosis on some varieties of bean. Nevertheless, the differences in symptom expression on other host plants, host ranges and physical properties are too great for this virus to be identified with either strain.
- (d) On bean, pea and soybean this virus induced symptoms similar to those caused by the pea streak virus, Chamberlain (7), but on other plants they are dissimilar. Further, the pea streak virus withstands higher temperatures and dilutions and longer ageing than this one.
- (e) This virus cannot be identified with the bean Southern mosaic, Zaumeyer and Harter (55) as the latter has a very restricted host range and high physical property values.
- (f) There are too few details of the bean yellow necrosis virus Johnson (21) and the *Dolichos* mosaic virus Capoor and Varma (5) for an accurate comparison to be made.
- (g) There are other non-legume viruses which result in a similar type of reaction on certain varieties of bean, e.g. tobacco necrosis virus causing stipple streak of bean, van der Want (50) and a tobacco streak strain causing red node of bean, Thomas and Zaumeyer (47, 48). Also the tobacco ringspot virus Pierce (30), tobacco broken ringspot virus, Smith and Markham (39) and a cucumber mosaic virus strain isolated from spinach by Fulton (12). With none of these is there a complete correlation.

From this account of the data available, it seems that the virosis described above cannot be wholly identified with any previously recorded disease.

It shows some similarities with several viruses and is probably related to one of them—meanwhile it is named the bean necrosis virus.

## 6.—BEAN VIRUS COMPLEX

When beans were inoculated with the sap from several naturally infected *Phaseolus vulgaris* and *Crotalaria spectabilis* plants, two distinct types of local lesions developed, viz. chlorotic spots or blotches and necrotic specks. After several transfers to and from other hosts, it became evident that more than one virus was involved.

For the convenience of others who may have to identify bean viruses, the complex is firstly described as such, and then the symptoms of the individual components are compared.

The virus causing the local chlorosis appears to be identical with the bean local chlorosis virus A, which has already been described and which occurs naturally on its own.

The second component, which results in the local necrotic lesions on bean, is named bean necrotic speckle virus. Apparently, it is not found alone in the field, but only in the complex.

Natural source of virus complex and locality:

(a) *Phaseolus vulgaris*. Pretoria and district, Groblersdal and Bronkhorstspuit.

Several varieties showed large chlorotic blotches on the older leaves, and a mottle on the younger ones. These were also crinkled and slightly malformed. Most plants were stunted. On some varieties e.g. Rooikrans there were necrotic specks on the leaves and sunken necrotic areas on the pods.

(b) *Crotalaria spectabilis*. Potchefstroom.

The leaves had dark green veinbands with irregular chlorotic areas interveinally. There were short necrotic stem streaks and the plants were stunted. Throughout this description, the following abbreviations will be used:—

Comp.—virus complex.

BLCV. A.—bean local chlorosis virus A.

BNSV.—bean necrotic speckle virus.

Physical properties: Thermal inactivation point 60–64°C.

Longevity *in vitro* 2–3 days.

Dilution end point 1:1,000–1:5,000.

These values refer to the complex and to the two components.

Transmission: Mechanical sap inoculation.

Aphid transmission tests were inconclusive.

Host range: *Arachis hypogaea* L., *Crotalaria juncea* L., *C. spectabilis* Roth.,

*Glycine max* (L.) Merr., *Lathyrus odoratus* L., *Lupinus albus* L., *L. luteus* L., *L. mutabilis* Sweet., *Medicago lupulina* L., *M. sativa* L., *Melilotus officinalis* Willd., *Phaseolus acutifolius* Gray var. *latifolius* Freem., *P. lunatus* L., *P. mungo* L., *P. vulgaris* L., *Pisum sativum* L., *Trifolium hybridum* L., *T. incarnatum* L., *T. pratense* L., *T. repens* L., *Vicia faba* L., *Vigna sesquipedalis* (L.) Wight., *V. unguiculata* (L.) Walp., *Voandzeia subterranea* Thouars.

BLCV. A is not able to infect *Glycine max*, *Medicago sativa* or *Trifolium repens*.

#### REACTION OF SUSCEPTIBLE SPECIES

*Arachis hypogaea*.

Local. No reaction.

Systemic. With all three viruses a mottle develops.

*Crotalaria juncea*.

Local. Comp. and BNSV. In nine days there are chlorotic spots with necrotic centres.

BLCV. A. No reaction.

Systemic. Comp. The growing point curves strongly to one side. The leaves are puckered with wavy margins and they have dark green blisters. The plant is rosetted and stunted.

BLCV. A. There is a crinkling of the leaves with a mottle and dark green blisters.

BNSV. After a vein-clearing of the young leaves, later formed ones are mottled with a necrotic sheen. The plant is stunted.

*C. spectabilis*.

Local. No reaction.

Systemic. The symptoms with all three viruses include a vein-clearing and/or chlorotic spotting, followed by a mottle with dark green blisters. The leaves are crinkled and the plant is slightly stunted.

*Glycine max*.

Local. Comp. and BNSV. Chlorotic spots develop in nine days.

Systemic. Both viruses cause a chlorotic spotting on the young leaves, and a mottle and malformation on later formed ones. Fig. 8D.

With BNSV. there are also necrotic specks on the old leaves.



*Lathyrus odoratus.*

Local. Comp. and BNSV. Small necrotic lesions develop.

BLCV. A. No reaction.

Systemic. With all three, the leaves are rolled and mottled. There are also dark green veinbands with BLCV. A.

*Lupinus albus.*

Local. Comp. and BNSV. There are small necrotic lesions and the leaflets absciss.

BLCV. A. No reaction.

Systemic. The three viruses induce a veinclearing or chlorotic spotting on the young leaves which remain folded. Later formed leaves are small and chlorotic with dark green blisters, and the plant is rosetted.

With the complex, the stem may become necrotic and the plant collapses.

*L. luteus.*

Local. No reaction.

Systemic. Comp. The young leaves are mottled and remain folded. Later formed leaves are malformed and almost stringlike, with large dark green blisters. The plant is stunted and rosetted.

BNSV. Chlorotic spots may develop. Later leaves have a dark green band along the midrib which is puckered, and the margins are rolled upwards. The plant is rosetted.

BLCV. A. The leaves are mottled, folded and crinkled.

*L. mutabilis.*

Local. Comp. There is a general necrosis and the leaflets absciss.

BNSV. and BLCV. A. No reaction.

Systemic. Comp. Necrotic stem streaks develop, the growing point curls to one side, and the plant eventually collapses.

BNSV. If the plants are young when infected, the reaction is similar to that of the complex. On older plants, there is a mottle on the leaves which are small and stringlike, and rosetted.

BLCV. A. The leaves are severely curled and very chlorotic with dark green blisters.

*Medicago lupulina.*

Local. No reaction.

Systemic. With the complex there are areas with mosaic markings, but with the other two viruses there is a mottle with dark green veinbands.

*M. sativa.*

Local. No reaction.

Systemic. Both the complex and BNSV cause a diffuse chlorotic spot mottle, and a slight malformation of the leaves.

*Melilotus officinalis.*

Local. No reaction.

Systemic. Comp. and BLCV. A. There is a mottle with chlorotic streaks and the leaves are malformed.

BNSV. Only a chlorotic mottle develops.

*Phaseolus acutifolius.*

Local. All three viruses induce a chlorotic spotting with necrotic veins or rings. The leaves collapse.

Systemic. Comp. The young leaves develop a veinclearing with necrosis, and they are severely curled. Later leaves have a speck mottle.

BNSV. This necrosis usually results in the collapse of the growing point. Should any secondary shoots develop, they have small, malformed and mottled leaves.

BLCV. A. There is a yellow network only.

*P. lunatus.*

Local. Comp. Chlorotic spots with necrotic specks develop.

BNSV. There are small necrotic specks in nine days.

BLCV. A. Chlorotic spots develop in four days.

Systemic. Comp. and BLCV. A. After a veinclearing, there are chlorotic flecks along the veins on most leaves.

BNSV. On the first trifoliates to show symptoms, there is a chlorotic network which soon becomes necrotic. Later formed leaves are speckled.

*P. mungo.*

Local. Same as for *P. lunatus*.

Systemic. Comp. The younger leaves develop chlorotic spots, each with a necrotic ring.

BNSV. After a chlorotic spotting on the young leaves, the next formed have dark green veinbands with irregular shaped chlorotic areas, which cause a distortion of the laminae. There are necrotic specks on the older leaves.

BLCV. A. Irregular chlorotic areas develop on some leaves.

*P. vulgaris* var. Canadian Wonder.

Local. Comp. In 4-5 days small necrotic specks develop which may fuse with closely adjacent ones. After six days there are also chlorotic spots, which develop independently from the specks. Fig. 8A.

BNSV. In 2-3 days necrotic specks develop.

BLCV. A. There are chlorotic spots in 4-5 days.

Systemic. Comp. The first trifoliates show large chlorotic blotches in 12-14 days. Young leaves have chlorotic spots, and later ones develop a mottle with dark green blisters. They are slightly puckered and may have twisted tips. The pods are mottled. Fig. 8B.

BNSV. After a chlorotic spotting of the young leaves, later ones develop a mottle, with dark green blisters. These leaves are malformed and elongated, and the plant is stunted.

BLCV. A. There is a veinclearing of the young leaves; later formed ones are mottled, crinkled and slightly malformed.

vars. Black Wonder and S.A. Black and White.

Local. Comp. and BLCV. A. Same as for Canadian Wonder.

BNSV. There are necrotic rings in addition to the necrotic specks.

Systemic. Same as for Canadian Wonder.

vars. Idaho Refugee, Long Tom, Tendergreen and Victor.

Local. Comp. Very few necrotic specks develop.

BNSV. and BLCV. A. Similar to that on Canadian Wonder.

Systemic. Same as for Canadian Wonder.

var. Haricot.

Local. Comp. In addition to the symptoms described for Canadian Wonder, there is a necrosis of the veins and petioles.

BNSV. There are necrotic specks, veins and petioles, Fig. 8C.

BLCV. A. Same as Canadian Wonder.

Systemic. Comp. and BNSV. There are necrotic specks and stem streaks which may result in the collapse of the plant.

BLCV. A. Similar to Canadian Wonder.

*Pisum sativum.*

Local. Comp. After a general necrosis the leaves collapse.

BLCV. A. The veins become necrotic and the leaves collapse.

BNSV. Necrotic spots develop.

Systemic. Comp. and BLCV. A. There is a veinclearing of the young leaves.

Later formed ones are mottled with necrosis setting in, in the chlorosis. The plant usually collapses.

BNSV. Most leaves develop chlorotic spots and veins, which soon become necrotic. The leaves remain folded, the tendrils are abnormally curled and the plant is rosetted. Later, necrotic stem streaks develop, which may lead to the ultimate collapse of the plant.

*Trifolium hybridum.*

Local. BNSV. There are diffuse chlorotic spots, with dark green rings.

Comp. and BLCV. A. No reaction.

Systemic. BNSV. There are chlorotic spots, streaks and ringspots.

Comp. and BLCV. A. A chlorotic streaking develops.

*T. incarnatum.*

Local. Comp. Chlorotic spots with necrotic rings develop.

BNSV. There are necrotic rings and a general chlorosis.

BLCV. A. Chlorotic spots develop.

Systemic. All three viruses cause a vein-clearing, and later a mottle with dark green areas, veinbands or blisters. With the complex and BLCV. A. the leaves are severely crinkled. With BNSV. necrosis may set in, in the chlorosis and the plant may collapse.

*T. pratense.*

Local. Comp. and BNSV. Small necrotic lesions may develop.

BLCV. A. No reaction.

Systemic. Comp. There are chlorotic blotches on the old leaves and chlorotic streaks on the younger ones. Necrosis may set in, in the latter, resulting in a distortion of the laminae.

BLCV. A. Similar symptoms develop.

BNSV. This virus is latent in the young leaves.

*T. repens.*

Local. No reaction.

Systemic. Comp. and BNSV. A chlorotic streak mottle develops, or there are no symptoms.

*Vicia faba.*

Local. Comp. Small necrotic specks develop.

BNSV. In addition there are necrotic rings.

BLCV. A. There are necrotic specks and chlorotic spots in 4-5 days.

Systemic. Comp. The older leaves develop large necrotic lesions which spread and fuse, and the leaves drop. This necrosis may continue into the growing point which then collapses; or the young leaves may be mottled.

BNSV. Very diffuse chlorotic spots with necrotic specks develop on the young leaves. Later formed leaves have almost yellow spots which soon become necrotic. Most leaves drop.

BLCV. A. After a chlorotic spotting, there is a mottle.

*Vigna sesquipedalis.*

Local. Comp. There are chlorotic spots with necrotic specks and veins. The leaves soon drop. Fig. 8E.

BNSV. Only the necrosis develops.

BLCV. A. Only the chlorotic spotting occurs.

Systemic. Comp. and BNSV. There is a vein-clearing of the young leaves. Later formed ones have dark green specks, veinbands and blisters, and they are rolled downward.

BLCV. A. No reaction.

*V. unguiculata.*

Local. With all three viruses there are necrotic specks and/or veins.

Systemic. The three viruses induce a chlorotic network followed by a mottle on later formed leaves.

With BNSV, there are also dark green blisters.

*Voandzeia subterranea*.

Local. Comp. and BNSV. Small chlorotic spots develop.

BLCV. A. No reaction.

Systemic. Comp. There are chlorotic spots and flecks on the young leaves. Later leaves have dark green veinbands and a necrotic sheen.

BNSV. The young leaves have chlorotic spots, with necrosis setting in.

BLCV. A. There is a chlorotic mottle.

## IDENTIFICATION.

This virus complex consists of two distinct components, which differ considerably in their individual symptom expression on most of the host plants tested.

The component causing the local chlorosis on bean has already been designated bean local chlorosis virus A—one of a group of viroses which result in this characteristic reaction.

On some varieties of bean this same type of local chlorosis occurs with the alfalfa yellow mosaic virus of Zaumeyer (53), but on many other host plants the symptoms do not agree.

With the alfalfa yellow mosaic, bean varieties develop either a local necrosis or a local chlorosis—never both symptoms simultaneously.

The second component, which causes small local necrotic lesions on bean, is named bean necrotic speckle virus. This symptom occurs both locally and systemically on many host plants, and on some species it is lethal.

Again, there are similarities in symptom expression on some varieties of bean, with those caused by alfalfa yellow mosaic virus, but differences on other hosts preclude complete correlation. Further, the host range of alfalfa yellow mosaic includes more susceptible species and it can withstand higher temperatures.

There are several other viruses, which, on some varieties of bean, cause the same combination of symptoms as occur with bean necrotic speckle virus, viz. local necrosis with systemic chlorosis.

The bean mosaic virus 4, Zaumeyer (56) and pod mottle virus, Zaumeyer (58) both have very restricted host ranges, and strong resistance to heating and ageing. The pea streak virus, Chamberlain (7) also withstands a very high dilution.

Although the red node virus, Thomas and Zaumeyer (47), yellow dot virus, Thomas and Zaumeyer (44) and white clover mosaic virus complex, Zaumeyer and Wade (60) do cause both local necrosis and systemic chlorosis, the descriptions of the type of symptom do not agree with those induced by bean necrotic speckle virus.

The local lesion strain of bean yellow mosaic virus, Thomas and Zaumeyer (49) results in similar symptoms on some bean varieties, but there are considerable differences in the symptoms on other plants, the host ranges and physical properties.

In England, a virus similar to the bean necrotic speckle virus was found on broad bean, also in combination with one causing local chlorotic spots on bean (22).

At the time, it was considered a new virus, but from recent literature, it now appears to be related to the lucerne (alfalfa) mosaic virus group.

There is a considerable resemblance between this virus and some of the many strains of lucerne mosaic, in respect of symptoms on several hosts, legume host range, and some physical property values; but it cannot be completely identified with any one of these variants.

It is therefore described here as a possible new strain and named bean necrotic speckle virus.



## BEAN YELLOW MOSAIC VIRUS

This virus is common on naturally infected *Lupinus albus* and *L. angustifolius*, in the Western Province. It has therefore been described in the paper on lupin virus diseases.

## BEAN YELLOW MOSAIC VIRUS, NECROTIC STRAIN

This strain was found on naturally infected *Lathyrus odoratus* in Pretoria and district. It is described under sweet pea virus diseases.

## LUPIN VIRUS B

This virus was also found on beans growing near various species of *Lupinus* in the Western Province. Details are given in the paper on lupin virus diseases.

In the field the symptoms are mild—only a chlorotic mottle and slight crinkling of the leaves.

## PEA WILT VIRUS STRAIN

In an experimental plot of Kentucky Wonder beans in the Rustenburg area, many plants showed vivid yellow spots on the leaves. There was also mottling, veinbanding and puckering, and the plants were stunted. This virus is described under pea virus diseases.

## SUMMARY

Details are given of bean virus diseases in South Africa, viz. four viruses and their several variants, and one virus complex. Mention is also made of a further two viruses and two strains, which have been described under other headings.

(a) Bean mosaic virus—the presence of this virus was confirmed.

(b) Bean mosaic virus strain—about 12 per cent seed transmission in the variety Canadian Wonder of unknown origin. Differs from the type virus in having a wider host range; and thermal inactivation point of 60–62°C., and longevity *in vitro* of 2–3 days.

(c) Bean chlorotic ringspot virus with four strains—probably related to the tobacco ringspot group. As the name suggests, this virus causes distinct ringspot patterns on the inoculated leaves of bean. It was isolated from *Crotalaria juncea*, *Erythrina caffra*, *Glycine max* and *Voandzeia subterranea*. The strains withstand heating to between 56–62°C., ageing between one and four days and dilutions of between 1:1000–1:10,000.

(d) Bean local chlorosis virus and seven variants—isolated from species of *Crotalaria*, *Glycine*, *Lathyrus*, *Medicago*, *Phaseolus* and *Trifolium*. The virus is named after the marked local chlorotic spotting on bean. The thermal inactivation points of the strains vary between 56–65°C., the longevity *in vitro* is between one and four days and the dilution end points are between 1:1000 and 1:5000.

(e) Bean necrosis virus—isolated from *Crotalaria spectabilis*, *Dolichos lablab* and *Glycine javanica*. Although the symptoms on the original host plants are mild, on bean there is a lethal necrosis. The virus is inactivated at temperatures of 65–70°C., after 6–7 days ageing, and at dilutions of between 1:5000–1:10,000. The relationship of this virus to others is uncertain.

(f) Bean virus complex. With isolates from *Phaseolus vulgaris*, *Crotalaria spectabilis* and *Glycine javanica*, two distinct local reactions developed on bean. One component was identified as a variant of the bean local chlorosis virus, and the other was named bean necrotic speckle virus. The latter is probably related to the lucerne mosaic virus group. For both components the thermal inactivation point is between 60–64°C., the longevity *in vitro* 2–3 days, and the dilution end point between 1:1000 and 1:5000.

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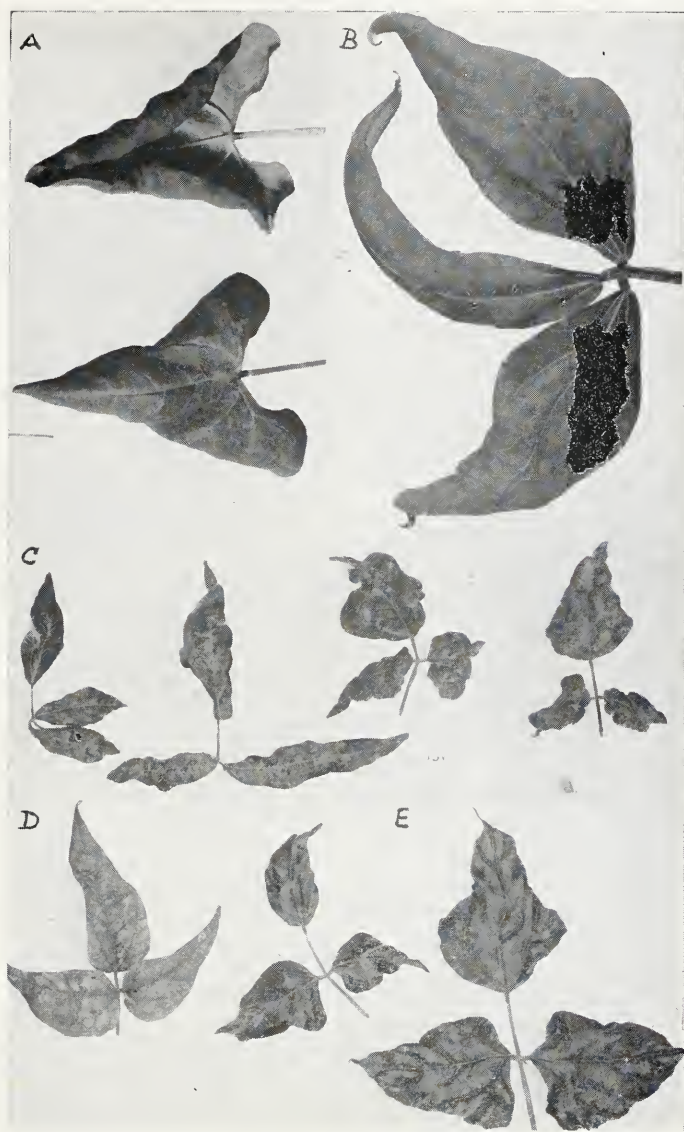


FIG. 1.—BEAN MOSAIC VIRUS.

*Phaseolus vulgaris* vars.

A and B. Canadian Wonder, from infected seed. A. Primary leaves. B. Trifoliate leaves. C. Long Tom. D. Idaho Refugee. E. Kentucky Wonder. C-E. Artificial infection.



FIG. 2.—BEAN MOSAIC VIRUS.  
*Phaseolus vulgaris* var. Haricot, from infected seed.

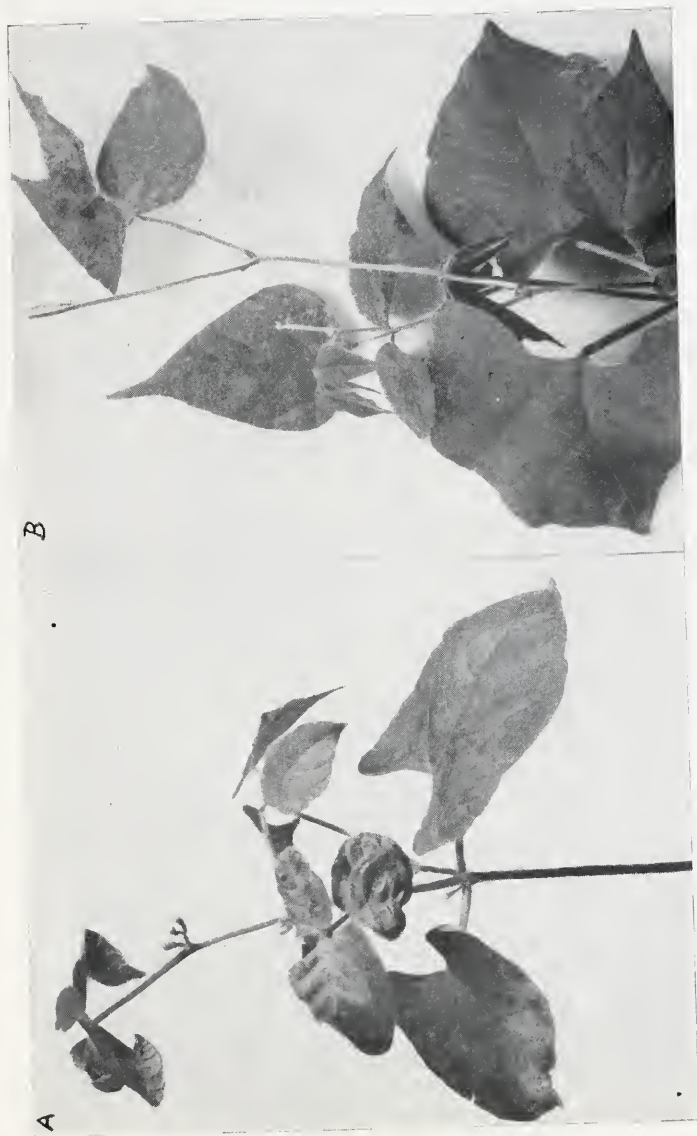


FIG. 3.—BEAN MOSAIC VIRUS STRAIN,  
*Phaseolus vulgaris* var. Canadian Wonder.  
A. From infected seed. B. Artificial infection.

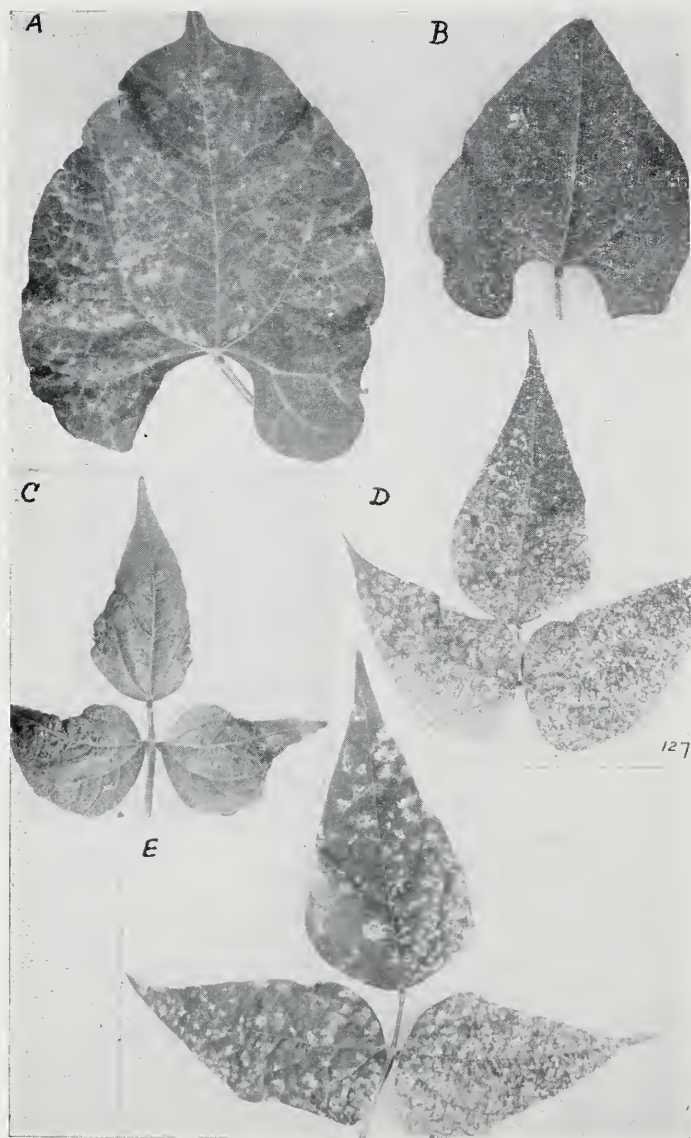


FIG. 4.—BEAN CHLOROTIC RINGSPOT VIRUS.

*Phaseolus vulgaris*.

A. var. Canadian Wonder, local lesions. B. var. Haricot, local lesions. C-E var. Canadian Wonder, systemic symptoms.



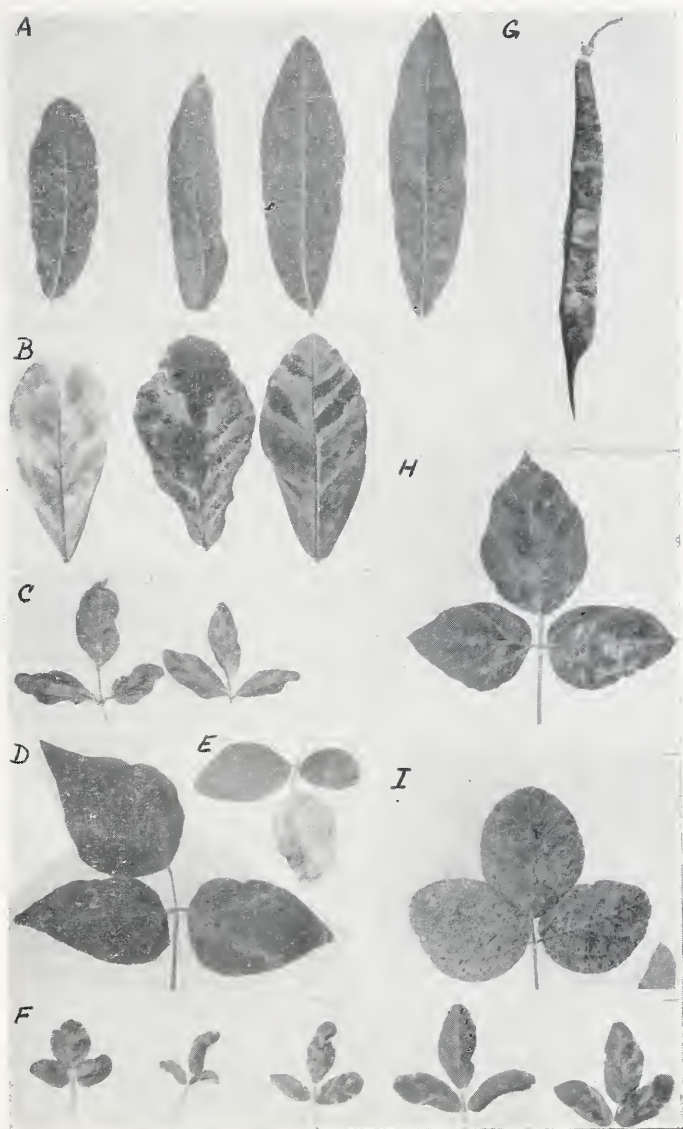


FIG. 5.—BEAN CHLOROTIC RINGSPOT VIRUS.

A. *Crotalaria juncea*. B. *C. spectabilis*. C. *Voandzeia subterranea*. D. *Phaseolus acutifolius*. E. *P. lunatus*. F. *Melilotus officinalis*. G. Pod of *Phaseolus vulgaris* var. Canadian Wonder. H and I. *Glycine max*.

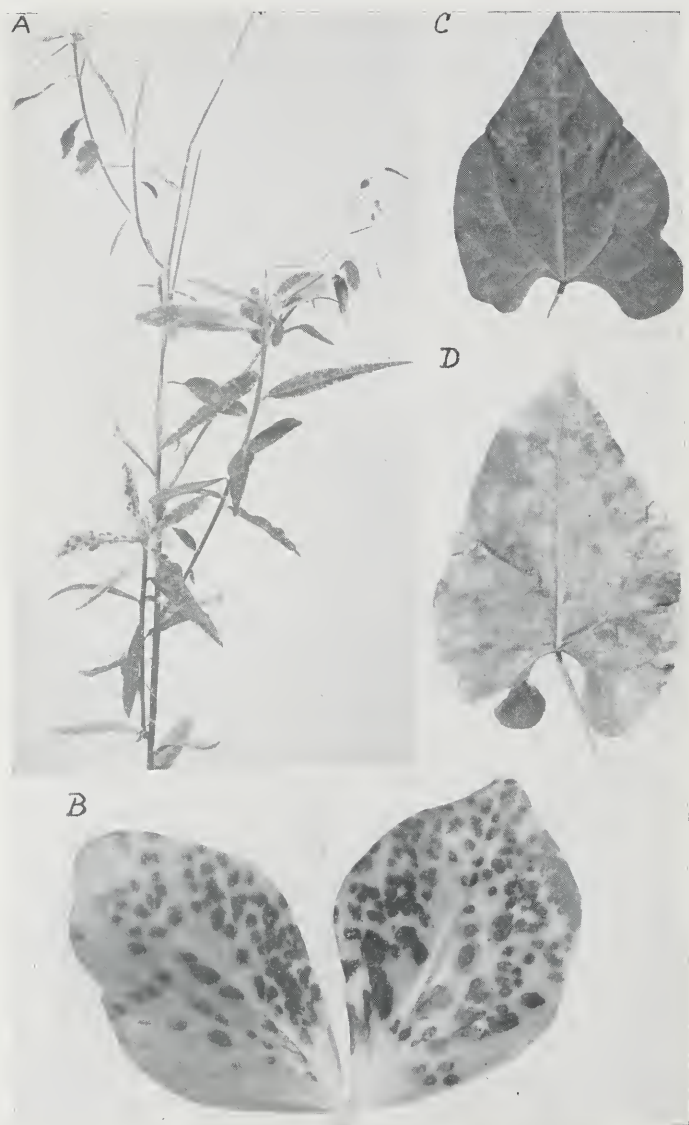


FIG. 6.—BEAN LOCAL CHLOROSIS VIRUS.

A. *Crotalaria juncea*. B. *Vicia faba*. C and D. *Phaseolus vulgaris* var, Canadian Wonder.



FIG. 7.—BEAN NECROSIS VIRUS.

A. *Phaseolus vulgaris* var. Canadian Wonder, systemic necrosis. B. *Melilotus officinalis*. C. *Phaseolus lunatus*. D. *Trifolium hybridum*. E. *Phaseolus vulgaris* var. Canadian Wonder, local reaction.



FIG. 8.—BEAN VIRUS COMPLEX.

A–C. *Phaseolus vulgaris*. A. var. Canadian Wonder, local reaction with the complex. B. Pods of var. Canadian Wonder. C. var. Haricot, local lesions with the bean necrotic speckle virus. D. *Glycine max*. E. *Vigna sesquipedalis*.



# A Contribution to our Knowledge of the Freshwater Algae of the Transvaal Province

by

M. I. Claassen,

*Department of General Botany, University of Pretoria.*

*with the Cooperation of the Division of Botany,*

*Department of Agriculture*

*(Being an abridged form of the thesis presented in partial fulfilment of the degree of Master of Science at the University of Pretoria)*

## CONTENTS

- I. Introduction.
- II. Enumeration of the Taxa.
- III. Vegetative Reproduction in Desmids.
- IV. Summary.
- V. Literature.

## I. INTRODUCTION

The freshwater algae occurring in the Transvaal districts of Warmbaths, Nylstroom and Naboomspruit have apparently not been investigated before. This study consisted of an enumeration of the taxa found, an investigation of vegetative reproduction in Desmids and a few hydrobiological observations.

The classification adopted here is essentially that of Wettstein (1935), W. and G. S. West (1904) and Hustedt (1930). Soon after the investigation was begun, it became apparent that many of the taxa found did not correspond with any already known and described. The new ones are described and illustrated in this paper.

It was possible to investigate cell division in the Desmids in living material; the rate of cell division proved to be of particular interest.

As it was impracticable to collect samples regularly from the various localities, no systematic hydrobiological observations could be made on variations in pH, periodicity, diurnal and annual fluctuations in temperature, etc., but where possible the pH of the water was measured at the time the material was gathered.

*Collection and Preservation of Samples.*—Samples were taken with a tablespoon from deposits on submerged rocks and mud in shallow pools, springs and small streams. Glass vials of 30 ml. capacity with plastic screw caps were used for keeping the samples. Twenty-seven ml. of the sample and 3 ml. of 40 per cent formalin were added to a vial.

Where living material was to be studied, the samples were placed in one-quart Ball jars together with a large volume of the water in which they had been found. The mouth of each jar was covered with a piece of waxed paper held in place by a rubber band.

*Mounting of the Material.*—It was found best to mount the algae in the liquid in which they were preserved or, to prevent drying out, in glycerine. Living material was mounted in the water in which the sample was collected or in distilled water. Where necessary a drop of distilled water was added to compensate for evaporation during microscopic examination.

*Drawings.*—Accurate scale drawings were made by means of a micrometer-net-ocular on specially printed squared paper.

*Type material.*—Owing to the fact that it is practically impossible to preserve the type material successfully over many years in a liquid medium, the author desires that the drawing plus the description of the new taxa described in the present paper constitute the type.

*Enumeration of the Samples and Localities.*—The samples were collected in the districts of Warmbaths, Nylstroom and Naboomspruit in the Northern Transvaal. The average altitude of the country exceeds 3,500 feet above sea-level, the maximum being about 5,000 feet. The area consists largely of sandstone with scattered groups of red-granite, diabase and quartz; but the lower country, south of Warmbaths and Naboomspruit, consists of basalt.

The following list of samples collected serves as a key; in the systematic portion of this paper, only the numbers of the samples are cited. Most of the samples were collected over a period extending from April, 1954 to July, 1955. The principal localities where collections were made are shown in Figure 1.

#### A.—Doornfontein and Leeupoort

Situated about 13 miles N.-N.W. of Nylstroom. The samples were collected from the Doornfontein Spruit and Leeupoort Dam. The locations are shown in Figure 2.

1. Greyish-brown deposit covering submerged stones in the spruit near drift, about half a mile S.W. of Leeupoort Dam, in slow-running water, 16·4·54; pH 6.2.
2. Greenish-brown ooze from side of road near drift, 16·4·54.
3. Reddish-brown ooze from side of road halfway between drift and Leeupoort Dam, 16·4·54.

The following samples were collected mainly from pools on rocks below the overflow on the S.W. side of Leeupoort Dam, 16·4·54.

4. Greenish-brown, stagnant water.
5. Orange masses floating on surface of small pool.
6. Reddish-brown deposit, stagnant water.
7. Attached to inner side of embankment of Leeupoort Dam, below surface of the water.
8. Decaying plants on moist part of embankment.
9. In pool on rocks, yellowish-brown.
10. Orange ooze on rocks.
11. Dirty orange-brown scum.
12. Greyish-brown deposit on bottom of pool next to spruit; pH 6.15.

Samples 13 to 17 were collected from Doornfontein Spruit about one mile N.E. of Leeupoort Dam (underneath bridge on asphalt road between Nylstroom and Vaalwater), 16·4·54.

13. Orange-brown growth among stones, N.E. side of stream under bridge, pH 6.35.
14. Orange- to greenish-brown scum next to 13.
15. Dirty orange-brown deposit, N.W. side under bridge, slow-running water.
16. Orange deposit from S.W. side under bridge, in placid water.
17. Greyish-brown deposit, from flowing water-furrow.

Samples collected near school about three miles N.E. of Leeupoort Dam, 16·4·54.

18. From pond, dirty orange- to greenish-brown scum, pH 5.75.
19. In furrow near pond, greyish-brown deposit.

Samples from Doornfontein Spruit about three miles N.E. of Leeupoort Dam, near school, 16·4·54.

20. From pool near stream, pH 6.1.
21. Another pool near the stream.
22. Orange-brown ooze from side of same pool as in 21.
23. Greenish-brown deposit on stones at drift, in running water, pH 6.25.

#### B.—*Moddernek*

Situated about nine miles N.-N.W. of Nylstroom. The part of the farm from which collections were made belongs to Mr. P. W. Botes. The samples were collected from springs, small ponds and water-furrows. The locations are shown in Figure 3.

24. Floodwater S.W. of spring A, 22·4·54.
25. Bottom of small pond (S. side), almost black deposit; about 90 yards S. of spring A, 22·4·54; pH 5.8.
26. Same as 25, 19·11·54.
27. Furrow between spring A and small pond, about 85 yards from spring A, 22·4·54.
28. *Spirogyra* species floating on surface of small pond, 22·4·54.
29. On E. side of larger pond, about 145 yards S. of spring A, 22·4·54.
30. On W. side of same pond, 2·4·55.
- 31, 32 and 33. Sides, surfaces and bottoms of furrows S. of the pond, 22·4·54.
- 34 and 35. From a vlei about three-quarters of a mile S.E. of spring A, 19·11·54; pH 6.31.
36. Near 25 and 26, 2·4·55; pH 5.85.
37. W. side of small pond, 2·4·55.
38. N. side of small pond, 2·4·55.
39. Spring B, 2·4·55; pH 5.45.
40. Spring A, orange scum from side, 2·4·55; pH 5. (This sample did not contain any algal flora.)
41. Furrow halfway between spring B and small pond, 2·4·55.

#### C.—*Rietfontein* 288

Situated about 28 miles N.-N.W. of Nylstroom. The farm belongs to Mr. J. E. Theron.

42. From spring, 6·4·55; pH 5.7.
43. Water from spring flowing into pond N.W. of spring, 6·4·55.
44. From N.E. side of vlei, W. of pond, 6·4·55.

#### D.—*Glentig*

A farm belonging to Mr. L. J. Groenewald; situated about seven miles E. of Rietfontein 288.

45. From spring, 21·11·54; pH 5.5.
46. From furrow, about 30 yards N. of spring, 21·11·54.

#### E.—*Warmbaths*

Samples collected between the old and new bridges over the Plat River, about 3-4 miles W. of Warmbaths; leg. Cholnoky.

47. Almost stagnant water in deep part of river, 30·5·54.
48. Slightly lower down, deposits on a flat stone, slow-running water, 30·5·54.
49. In shade of new bridge in slow-running water, brown covering on sand, 30·5·54.
50. Near 49, deep bend in river in slow-running water, 30·5·54.

## F.—Between Warmbaths and Nylstroom

Samples from a tributary of the Nyl River and other places near the road about halfway between Warmbaths and Nylstroom; leg. Cholnoky.

51. Side of waterfall W. of road, swift-running water over sandstone, 6·6·54.
52. A small tributary, slow-running water, 6·6·54.
53. On rocks, stagnant water, 6·6·54.
54. Shallow water from river above the waterfall, 6·6·54; pH 6.35.
- Samples collected in a vlei E. of the road; pH 6.2.
55. About 200 yards from bridge, beginning of a vlei, stagnant water, 6·6·54.
56. Small pools further down the vlei, 6·6·54.
- 57 and 58. Two places in the vlei on *Gramineae* and *Cyperaceae*, 6·6·54.

## G.—Kranskop

Situated about seven miles E. of Nylstroom; leg. Cholnoky.

59. Small pond with partly broken bank, about 100 yards in diameter, stagnant water with *Marsilea* and *Nymphaea*, 6·6·54; pH 6.75.
60. Overflow of pond, swift-running water, 6·6·54.
- Samples from a tributary of the Nyl River near Kranskop.
61. Shallow water near the bank, 6·6·54.
62. Deeper, slow-running water from the main part of the stream, 6·6·54.

## H.—Modderpoort

The farm belonging to Mr. G. Moerdyk between Warmbaths and Nylstroom, not far from the locality where samples 51–58 were collected; leg. Cholnoky.

- 63 and 64. Further from the road to the west, two samples collected on stones in the river, 6·6·54; pH 6.2.

## I.—Mosdene

Samples collected on the farm of Mr. E. A. Galpin, near Naboomspruit, 12·7·55; pH 6.1–6.4; leg. Cholnoky.

65. From the portion of the farm called Masoga, in a swimming pool among *Myriophyllum*.
66. From the shallow part of a vlei with a sandy bottom on Masoga.
67. Same locality as 66 but in deep water among Green Algae.
68. Wall of Premier Dam, overflow, slow-running water, among *Marsilea*.
69. From Premier Dam; the bottom of the dam was sampled at a place far from the bank, and where the water was one metre deep.
70. A vlei situated between the Premier Dam and the Nyl River; in water about 10 cm. deep.
71. Near 70, in a furrow near the Nyl-road.
72. From the Nyl River, in swift-running water, on marshy sand; clearly oligotrophic.
73. From the Nyl Dam near the Nyl River, large algal masses.
74. Premier Dam, living material; leg. Dr. S. Saubert.

*Geographical Distribution.*—In the taxonomic part of this paper, the general geographical distribution of each taxon of the Desmidiaceae encountered has been added. As the author was unable to study all literature dealing with Desmids, the details regarding their geographical distribution must needs be considered incomplete.



## II.—ENUMERATION OF THE TAXA

## TRIBUS: SCHIZOPHYTA

Class: Schizophyceae (Cyanophyceae).

Order: Chroococcales.

Fam.: Chroococcaceae.

## Merismopedia Meyen

1. *M. convoluta* Bréb. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 106.) Sample 20.
2. *M. glauca* (Ehrenb.) Näg. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 106, fig. 125.) Samples 47, 48.
3. *M. punctata* Meyen. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 106, fig. 124.) Samples 39, 48.

Order: Hormogonales.

Fam.: Stigonemataceae.

## Stigonema Ag.

4. *S. pseudominutum* spec. nova, *S. minuto* (Ag.) Hass. affinis, sed filamentis et hormogoniis tam angustis ut vel  $5\ \mu$  aequantibus, vaginis filamentorum vetustiorum luteo-fulvis et heterocystis nonnumquam etiam terminalibus differt.

Except for the considerably narrower threads and hormogonia this agrees with *S. minuto* (Ag.) Hass. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 186, figs. 224, 225); the heterocysts occupy terminal as well as lateral and intercalary positions. The cells are arranged in 1-4 series, but mainly in a single series. The threads are well-branched, the branches being narrower than the main axis. The older sheaths are yellowish-brown in colour whereas the younger sheaths are colourless. Diameter of threads  $5-20\ \mu$ . (Tab. 1, figs. 1, 2.) Sample 27.

Fam.: Scytonemataceae.

## Scytonema Ag.

5. *S. myochrous* (Dillw.) Ag. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 275, figs. 324, 325.) Threads narrower than in the typical form and some of the cells are shorter than broad; parts of the sheath lack the diverging layers. Breadth of thread  $10-24\ \mu$ ; breadth of cells  $5-7\ \mu$ ; length of cells  $3-6\ \mu$ ; breadth of heterocysts  $8\ \mu$ ; length of heterocysts  $9-10\ \mu$ . (Tab. 1, figs. 3-7.) Sample 22.

Fam.: Nostocaceae.

## Nostoc Vaucher

6. *N. commune* Vaucher (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 301, fig. 350). Sample 29.
7. *N. nylstronicum* spec. nova, *N. muscorum* Kütz. affinis, sed heterocystis cylindratis (nunquam apice rotundatis) valde distincta. „Dauerzellen” abesse videntur.

This species comes nearest to *N. muscorum* Kütz. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 299, fig. 349), but can be distinguished by the shape of the heterocysts which are cylindrical in outline; no „Dauerzellen” were observed. Trichomes loosely twisted, blue-green in colour; cells cylindrical,  $2.8-3.6\ \mu$  broad and  $3.5-8.75\ \mu$  long. Heterocysts  $3.85-4.4\ \mu$  broad and  $5.6-9.5\ \mu$  long. A number of trichomes within a common mucilaginous sheath. (Tab. 2, fig. 2.) Sample 20.

8. *N. pseudogelatinosum* spec. nova, *N. gelatinoso* Schousboe affinis, sed differt magnitudine aliquanto minore et cellulis interdum non longioribus quam latoribus; constrictio saeptorum magis conspicua, heterocystorum nulla nisi terminalia sunt, neque ullae „Dauerzellen” adesse videntur.

This differs from *N. gelatinosum* Schousboe (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 298, fig. 347) in having smaller dimensions, more marked constrictions at the septa, terminal heterocysts, no „Dauerzellen” and cells which can be as long as they are broad. Trichomes irregularly twisted, blue-green in colour; cells quadrate or cylindrical,  $2.4\text{--}2.8\text{ }\mu$  broad and  $2.4\text{--}6.3\text{ }\mu$  long; heterocysts always occupy a terminal position, more or less elliptical in outline,  $3.1\text{--}4\text{ }\mu$  broad and  $5.5\text{--}7.9\text{ }\mu$  long. Only the common sheath, within which a number of trichomes occur, is distinct and of a dirty yellowish colour. (Tab. 2, fig. 1.) Sample 20.

### *Anabaena Bory*

9. *A. galpinii* spec. nova, *A. affini* Lemm. affinis, sed trichomatis semper separatis, vaginae mucosae abesse videntur; cellulae breviores quam latiores. „Dauerzellen” iuxta heterocysta sitae sunt.

This species differs from *A. affinis* Lemm. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 320, fig. 374) in having individual trichomes (not containing a number of trichomes within a common sheath), in the absence of a sheath, in the position of the „Dauerzellen” (adjacent to the heterocysts), and in the cells being shorter than broad. Trichomes free-floating, straight, blue-green in colour; cells  $8.5\text{--}9\text{ }\mu$  broad and  $4.3\text{--}6.8\text{ }\mu$  long; heterocysts more or less spherical,  $8.5\text{--}9\text{ }\mu$  broad and  $8\text{--}9\text{ }\mu$  long. „Dauerzellen” single, oval, bright blue-green in colour and more granular than the vegetative cells, about  $11\text{ }\mu$  broad and  $16\text{ }\mu$  long. (Tab. 2, fig. 3.) Sample 66.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

10. *A. mesiana* spec. nova, *A. catenulae* (Kütz.) Born. et Flah. affinis, sed differt et trichomatis semper separatis et quod vagina mucosa abest. „Dauerzellen” breviores adsunt.

This species is near *A. catenula* (Kütz.) Born. et Flah. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 318, fig. 370); however the trichomes are single and the „Dauerzellen” are not as long as in Born. and Flah.’s species. Trichomes free-floating, straight, blue-green in colour; no sheaths were discernible. Cells spherical or slightly elliptical,  $5\text{--}6\text{ }\mu$  broad and  $5\text{--}7\text{ }\mu$  long. „Dauerzellen” single, adjacent to the heterocysts, oblong,  $7.5\text{--}8\text{ }\mu$  broad and  $11.5\text{--}19\text{ }\mu$  long. (Tab. 2, fig. 4.) Sample 66.

This species is named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

11. *A. pseudocatenula* spec. nova, *A. catenulae* (Kütz.) Born. et Flah. affinis, sed eo differt quod separata sunt trichomata, vagina mucosa abesse videtur, cellulae vero minores sunt ac breviores quam latiores neque ullae „Dauerzellen” visae sunt.

This species closely resembles *A. catenula* (Kütz.) Born. and Flah., but the trichomes are single, the cells are smaller and shorter than broad and no sheaths or „Dauerzellen” were observed. Trichomes free-floating, straight, blue-green in colour. Cells  $3.16\text{--}3.65\text{ }\mu$  broad and  $1.58\text{--}3.5\text{ }\mu$  long. Heterocysts elliptical,  $3.5\text{ }\mu$  broad and  $6.63\text{ }\mu$  long. (Tab. 2, fig. 5.) Sample 1.

Fam.: Oscillatoriaceae.

### *Oscillatoria Vaucher*

12. *O. nylstromica* spec. nova, *O. simplicissimae* Gom. affinis, sed trichomatis angustioribus subcaeruleisque, cellulis brevioribus vel tam longis quam latis bene distinguenda.

This species agrees superficially with *O. simplicissima* Gom. (Geitler & Pascher, Süßwasserflora, 12, 1925, p. 364, fig. 429), but the trichomes are narrower, and light steel-blue in colour, and the cells are shorter than broad, or quadrate. Trichomes solitary, free-floating, more or less straight, not tapering towards the extremities,  $4.6-4.75 \mu$  broad. Cells granular at the septa and not constricted,  $1.45-4.8 \mu$  long. Apical cell broadly rounded, without calyptra. (Tab. 2, fig. 7.) Samples 1, 11.

13. *O. princeps* Vaucher. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 358, fig. 421.) Sample 47.

14. *O. subpristleyi* spec. nova, *O. pristleyi* W. et G. S. West affinis, sed valde differt quod trichomata extrema non curvantur et quod cellulae paulo angustiores porro longiores quam latiores sunt neque ad saepta constrictae.

This specimen closely resembles *O. pristleyi* W. et G. S. West (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 371, fig. 451), but differs from the latter in the absence of a curvature near the apex, the narrower trichomes, the cells being longer than broad and in the absence of constrictions at the septa. Trichomes solitary, free-floating, bright blue-green in colour, more or less straight, tapering towards the extremities, cells  $3.16-5.5 \mu$  broad and  $4.7-9.5 \mu$  long, granular at the septa. Apical cell slightly pointed, without calyptra. (Tab. 2, fig. 6.) Sample 1.

15. *O. tenuis* Ag. (Geitler & Pascher: Süßwasserflora, 12, 1925, p. 362, figs. 427, 428a.) (Tab. 2, fig. 8.) Samples 1, 5, 7, 9, 11, 12, 13, 14, 15, 18.

16. *O. waterbergensis* spec. nova, *O. annae* van Goor affinis, sed differt eo quod cellulae ad saepta non nisi levissime constrictae, breviores vel paulo longiores quam latiores et ad saepta granulatae sunt neque trichomata ad apicem sunt curvata.

This species agrees superficially with *O. annae* van Goor (Huber-Pestalozzi: Die Binnengewässer, Band XVI, Teil 1, p. 232, fig. 171); but some of the cells are longer than broad, and the trichomes lack a curvature near the apex, are slightly constricted at the septa and are granular. Trichomes more or less straight, greyish-green in colour, not tapering towards the extremities,  $7-7.5 \mu$  broad. Cells  $4.75-8 \mu$  long; apical cell rounded, without calyptra. (Tab. 2, fig. 9.) Sample 1.

### Lyngbya Ag.

17. *L. uliginosa* spec. nova. Nulla affinitate obvia. Cellulae vel tam longae quam latae vel etiam longiores, filamentis ad saepta manifeste constrictae sunt; filamenta separata sunt neque vagina mucosa arte ad trichomata adhaeret.

Threads straight, solitary, free-floating,  $4.5-5.1 \mu$  broad; sheath of the filament thin, colourless, encircling the trichome loosely. Trichomes constricted at septa,  $2.8-3.3 \mu$  broad; cells  $2.8-6.2 \mu$  long, dark green in colour; apical cell rounded. (Tab. 2, fig. 10.) Sample 3.

### TRIBUS: MONADOPHYTA

Class: Flagellatae.

Order: Euglenineae.

Fam.: Euglenaceae.

### Euglena Ehrenb.

18. *E. spirogyra* Ehrenb. var. *major* var. nova. Haec specimina multo maiora sunt quam typus et varietates speciei adhuc notae, neque ullae formae intermediae visae sunt.

This variety is much larger than the type and its varieties, with the exception of var. *suprema* Skuja (Huber-Pestalozzi: Die Binnengewässer, Band XVI, Teil 4, p. 102, fig. 83), from which it differs in shape and breadth of cells. Cells  $152-196 \mu$  long and  $22-26 \mu$  broad. (Tab. 32, fig. 11.) Samples 25, 39.

As most Flagellates are either completely dissolved or quite unidentifiable in formalin-treated material, examination of living material must be made for their recognition. Several unidentifiable *Euglena* species were found in samples 2, 23, 24, 25, 26, 27, 34, 35, 36 and 47.

#### *Phacus* Dujardin

19. *Ph. pleuronectes* (O.F.M.) Duj. (Pascher & Lemmermann: Süßwasserflora, 2, 1913, p. 138, fig. 236.) Samples 1, 12, 32, 34, 35.

#### TRIBUS: CONJUGATOPHYTA

*Class:* Conjugatae.

*Fam.:* Mesotaeniaceae.

#### *Cylindrocystis* Menegh.

20. *C. barbarica* spec. nova, affinis *C. crassae* De Bary, sed cellulis 1.2–1.4-plo longioribus quam latioribus, etiam forma chromatophorum differt, quippe quibus processus minus sint radiantes.

This species superficially agrees with *C. crassa* De Bary (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 59, Pl. IV, figs. 33–38); but the cells are about 1.2–1.4 times longer than broad and the chloroplasts possess fewer radiating processes. Cells small, unconstricted, subcylindrical, with the apices broadly rounded; cell wall smooth and colourless; chloroplasts stellate with a few radiating processes. Length 28–32  $\mu$ ; breadth 23–24  $\mu$ . (Tab. 3, fig. 1.) Sample 19.

21. *C. caffra* spec. nova, affinis *C. brébissonii* Menegh., sed cellulis latioribus, etiam forma chromatophori differt.

This species somewhat resembles *C. brébissonii* Menegh. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 58, Pl. IV, figs. 23–32; Pl. V, fig. 10); but the cells are broader than in Meneghini's species and the shape of the chloroplast differs. Cells of medium size, cylindrical, unconstricted, about 1.7–2.6 times longer than their diameter, apices rounded, chloroplasts with a few radiating prolongations; cell wall smooth and colourless. Length 36–58  $\mu$ ; breadth 20–24  $\mu$ . (Tab. 3, fig. 2.) Samples 18, 19.

#### *Netrium* Näg.

22. *N. digitus* (Ehrenb.) Itzigs. & Rothe. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 64, Pl. VI, figs. 14–16.) Several of the specimens measured are considerably smaller than in the typical form namely 92–126  $\mu$  long, 33–44  $\mu$  broad and 15–20  $\mu$  broad near the apices. Samples 2, 19, 22, 25, 35, 39, 41, 66, 68, 69, 70.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; Generally distributed in Europe; Faeroes; India; Ceylon; Siam; Java; Central China; Japan; Australia; New Zealand; Azores; United States; British Guiana; Brazil; Portuguese East Africa; South Africa.

23. *N. oblongum* (De Bary) Lütke. var. *cylindricum* W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 67, Pl. V, fig. 7.) Sample 25.

*Geographical Distribution.*—England; Wales; Scotland; Italy; Somaliland; Japan; South Africa.



Order: Desmidiaceae.

Fam.: Desmidiaceae.

Subfam.: Saccodermatae.

### Gonatozygon De Bary

24. *G. monotaenium* De Bary. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 30, Pl. I, figs. 1-7; Pl. V, fig. 5.) Sample 20.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Hungary; Sweden; Faeroes; N. Russia; Greenland; India; Ceylon; Siam; Sumatra; West, Central and East Africa; W. Indies; United States; Brazil (var.); South Africa.

Subfam.: Placodermatae.

### Penium Bréb.

25. *P. barbaricum* spec. nova, affinis *P. margaritaceo* (Ehrenb.) Bréb., sed granulis membranae diffuse (neque in seriebus longitudinalibus) dispositis, membranaque achroa differt.

This species superficially resembles *P. margaritaceum* (Ehrenb.) Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 83, Pl. VIII, figs. 32-35); but the cell wall is colourless and furnished with numerous scattered granules. Cells of medium size, about 3·2-6·3 times longer than their diameter, with a distinct median constriction, apices rounded. Length 70-144  $\mu$ ; breadth 18-23  $\mu$ . (Tab. 3, fig. 6.) Samples 20, 47, 48.

26. *Penium* species ad *P. cruciferum* (De Bary) Wittr. Cellulae cum *P. crucifero* valde congruentes praeterquam quod paulo minores sunt neque ullae costae in chromatophora visae sunt. Zygospora inventa est sed *P. cruciferi* zygospora adhuc ignoratur.

This comes very near *P. cruciferum* (De Bary) Wittr. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 100, Pl. X, figs. 18-19), but the cells are slightly smaller and no ridges were observed in the chloroplasts. A zygospora was found, but the zygospora of *P. cruciferum* has hitherto been unknown. The cells are very small, about 1·7-2·2 times longer than their diameter; ellipsoid-subcylindrical with a slight median constriction, apices rounded; cell wall smooth and colourless; each chloroplast with a central pyrenoid. Zygospora subquadrate, sides concave; cell wall straw-coloured. Length 12-13  $\mu$ ; breadth 6-7  $\mu$ ; diameter of zygospora 12-14  $\mu$ . (Tab. 3, figs. 16-17.) Sample 35.

27. *P. cucurbitinum* Biss. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 94, Pl. IX, figs. 13, 14.) Sample 39.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; Japan; South Africa.

28. *P. cucurbitinum* f. *botesii* f. nova, affinis *P. cucurbitino* formae *minori* West, sed cellulis multo minoribus, apice hebetato, punctis in 8 series longitudinales ordinatis differt.

This species somewhat resembles *P. cucurbitinum* f. *minor* West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 95, Pl. IX, fig. 16); but the cells are much smaller, with the apices truncate; cell wall punctate, punctae arranged in about eight longitudinal rows. Cells small, about twice as long as broad, with a slight median constriction; chloroplasts with about four longitudinal ridges. Length 24-28  $\mu$ ; breadth 11-14  $\mu$ ; breadth of isthmus 7-10  $\mu$ . (Tab. 3, fig. 15.) Sample 27.

Named after Mr. P. W. Botes of Moddernek, Nylstroom.

29. *P. curtum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 97, Pl. X, figs. 21, 22.) Samples 7, 11, 32.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria; Italy; Norway; Sweden; Greenland; Spitzbergen; Nova Zembla; Franz-Joseph Land; India; Burma; Siam; West Africa; Madagascar; West Indies; United States; South Africa.

30. *P. curtum* var. *waterbergense* var. nova, a typo speciei membrana ad apices cellulae haud incrassata et sculptura membranae differt.

This agrees somewhat with the typical form, but differs in the absence of a cell wall thickening at the apices and in the sculpture of the cell wall. Cell wall punctate, punctae arranged in about eight longitudinal rows. Length 27–33  $\mu$ ; breadth 18–20  $\mu$ ; breadth of isthmus 16–18  $\mu$ . (Tab. 3, fig. 9.) Samples 30, 51, 52, 53, 54, 58, 64.

31. *P. jenneri* Ralfs. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 77, Pl. VII, figs. 20, 21.) Sample 2.

*Geographical Distribution*.—England; Scotland; Ireland; Germany; Austria; Norway; Sweden; Poland; South Africa.

32. *P. libellula* (Focke) Nordst. var. *schweickerdtii* var. nova, affinis *P. libellulae* var. *interrupto* W. et G. S. West, sed cellulis 3·8–5-plo longioribus quam latioribus chromatophoris constrictis neque interruptis differt.

This approaches *P. libellula* var. *interruptum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 74, Pl. VII, figs. 9–10); but the cells are shorter, and 3·8–5 times longer than their diameter; chloroplasts constricted and not transversely divided. Cells of medium size, unconstricted, fusiform, apices slightly truncately rounded; chloroplasts with about 10 longitudinal ridges. Length 68–108  $\mu$ ; breadth 16–25  $\mu$ ; breadth near apices 6–12  $\mu$ . (Tab. 3, fig. 7.) Samples 2, 24, 25, 27, 32, 39, 41.

Named after Prof. Dr. H. G. Schweickerdt, Head of the Department of General Botany, University of Pretoria.

33. *P. margaritaceum* (Ehrenb.) Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 83, Pl. VIII, figs. 32–35.) Tab. 3, fig. 3 shows a form during cell-division in which the cell wall is furnished with longitudinal rows of granules, but the granules are irregularly scattered at the apices. Samples 13, 18, 19.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria; Poland; Hungary; Italy; Portugal; Norway; Sweden; Finland; Lapland in Russia; Faeroes; Greenland; Spitzbergen; Java; New Zealand; East Africa; Azores; United States; Ecuador; Switzerland; South Africa.

34. *P. margaritaceum* var. *brevior* var. nova, a typo speciei cellulis valde latioribus fere 3·6–4·8-plo longioribus quam latioribus differt.

Length in proportion to breadth differs from the typical form; cells 3·6–4·8 times longer than their diameter. Length 84–96  $\mu$ ; breadth 20–23  $\mu$ . (Tab. 3, fig. 5.) Samples 13, 19.

35. *P. margaritaceum* var. *incognitum* var. nova, a typo speciei semicellulis ad basim tumidis similiter ac apud genus *Pleurotaenium* Näg. differt.

This variety differs from the typical form in possessing a basal inflation in each semicell similar to that found in the genus *Pleurotaenium* Näg. Cells large, 7·7–8·4 times longer than their diameter, apices rounded; cell wall yellowish-brown and furnished with longitudinal rows of granules; chloroplasts with about 10 longitudinal plates (or ridges) and showing a median interruption. Length of cell 184–185  $\mu$ ; breadth at base of semicell 22  $\mu$ , near basal inflation 18–18·5  $\mu$ , at middle of semicell 22–24  $\mu$ , at apices 16–17  $\mu$ . (Tab. 3, fig. 4.) Sample 13.

36. *P. mesianum* spec. nova, affinis *P. phymatosporo* Nordst., sed membrana cellulae granulata haud striata differt.

This is near *P. phymatosporum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 91, Pl. VI, figs. 9–11); but the cell wall is furnished with minute granules and is not striated. Cells small, more than twice as long as broad, with a slight median constriction; apices truncately rounded; cell wall conspicuously covered with granules; each chloroplast has a single pyrenoid. Length 32–42  $\mu$ ; breadth 13–16  $\mu$ . (Tab. 3, figs. 10–13.) Samples 3, 24, 27.

Named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

37. *P. navicula* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 75, Pl. VII, figs. 12–15, 19.) Specimens were found with length 33–80  $\mu$ ; breadth 12–20  $\mu$ ; breadth of apices 6–8  $\mu$ . Samples 2, 51, 52, 53, 54, 57, 58, 63.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria; Hungary; Norway; Sweden; Italy; Russia; Lapland; Faeroes; Greenland; India; Ceylon; Singapore; United States; Brazil; First record for South Africa.

38. *P. phymatosporum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 91, Pl. VI, figs. 9–11.) Sample 2.

*Geographical Distribution*.—England; Scotland; Ireland; France; Austria; Italy; Argentina; Trinidad (?); Japan; Switzerland; Nantucket, U.S.A.; South Africa.

39. *P. pseudorufescens* spec. nova, affinis *P. rufescenti* Cleve, sed cellula dimidio minore differt; constrictura media haud visa, membrana achroa.

Near *P. rufescens* Cleve (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 99, Pl. VI, figs. 12, 13); but the cells are only about half the size of those of Cleve's species; no trace of a constriction in the middle of the cell was found; cell wall colourless. Cells small, about 2.5–3 times longer than their diameter, slightly attenuated towards the apices, which are rounded; cell wall smooth. Length 28–30  $\mu$ ; breadth 9–12  $\mu$ . (Tab. 3, fig. 14.) Sample 24.

40. *P. subcucurbitinum* spec. nova, affinis *P. cucurbitino* Biss., sed cellulis fere duplo longioribus quam latoribus, apice hebetato nec non sculptura membranae differt.

Near *P. cucurbitinum* Biss. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 94, Pl. IX, figs. 13, 14); however the cells are about two times longer than their diameter, and the apices are truncate; it also differs in the sculpture of the cell wall. Cells small, subcylindrical, with a slight median constriction, gradually attenuated towards the apices; cell wall furnished with granules. Length 39  $\mu$ ; breadth 20  $\mu$ . (Tab. 3, fig. 8.) Sample 39.

### *Closterium Nitzsch*

41. *C. abruptum* West var. *westiorum* var. nova, affinis *C. abrupto* var. *breviori* W. et G. S. West, sed cellulis minus arcuatis vel rectis et polis hebetatis differt.

Near *C. abruptum* var. *brevius* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 160, Pl. XX, figs. 11, 12); but the cells are less curved or practically straight and the apices are more truncate. Cells about 5.9–6.5 times longer than their diameter. Chloroplasts with about eight ridges and a central series of 2–3 pyrenoids. Length 75–84  $\mu$ ; breadth 12–13  $\mu$ ; breadth of apices 6–7  $\mu$ . (Tab. 6, figs. 9, 10.) Sample 2.

Named after Messrs. W. & G. S. West.

42. *C. acerosum* (Schrank) Ehrenb. var. *waterbergense* var. nova, affinis *C. aceroso* var. *elongato* Bréb., sed cellulis valde minoribus et polis hebetatis differt.

This comes near *C. acerosum* var. *elongatum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 148, Pl. XVIII, fig. 1); but differs in having smaller cells with truncate apices. Cells of medium size, about 9·5–10·5 times longer than their diameter, inner margin slightly concave, gradually attenuated towards the apices, which are truncate; cell wall yellowish-brown, striated, about 40 striae visible across the cell; chloroplasts with about eight ridges and a central series of 10–15 pyrenoids; terminal vacuoles with a number of moving granules. Length 398–432  $\mu$ ; breadth 41–42  $\mu$ ; breadth of apices 8  $\mu$ . (Tab. 4, figs. 6, 7.) Sample 54.

43. *C. acutum* (Lyngb.) Bréb. var. *linea* (Perty) W. & G. S. West f. *minor* f. nova, a varietate *linea* (Perty) W. et G. S. West cellulis multo brevioribus (nec angustioribus) differt.

The cells are considerably shorter than those in var. *linea* (Perty) W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 178, Pl. XXIII, fig. 15), but have the same breadth. Cells 16–18 times longer than their diameter; chloroplasts with 3–4 pyrenoids; terminal vacuoles with one moving granule. Length 64–88  $\mu$ ; breadth 4–5  $\mu$ . (Tab. 6, fig. 22.) Sample 22.

44. *C. atomicum* spec. nova, affinis *C. striolata* Ehrenb., sed differt cellulis multo minoribus, margine ventrali medio incrassato, membrana cellulæ 14 striis quae videre possunt ornata.

This is near *C. striolatum* Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 122, Pl. XIII, figs. 7–16); but the cells are considerably smaller, inner margin tumid in the median part. Cells of medium size, 7–8 times longer than their diameter, curved, inner margin concave and tumid in the median portion, gradually attenuated towards the apices, which are slightly truncate; cell wall yellowish-brown, about 14 striae visible across the cell. Length 160–196  $\mu$ ; breadth 22·5–26  $\mu$ ; breadth of apices 9–12  $\mu$ . (Tab. 5, fig. 16.) Sample 3.

45. *C. barbaricum* spec. nova, affinis *C. parvulo* Näg., sed cellulis minus arcuatis, polis hebetatis, vacuolis terminalibus granulo singulo se moventi praeditis differt.

This species differs from *C. parvulum* Näg. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 133, Pl. XV, figs. 9–12) in the cells having a smaller curvature, the apices being acute and in the terminal vacuoles containing only one moving granule. Cells small, 7–9 times longer than their diameter, curved, inner margin concave, not tumid, gradually attenuated towards the apices, which are truncately-rounded; cell wall smooth and colourless; chloroplasts with six ridges and six pyrenoids. Figs. 5 and 6 show cells which have atypical apices, possibly owing to the fixative used. Length 66–92·5  $\mu$ ; breadth 8–11·5  $\mu$ . (Tab. 6, figs. 4–6.) Sample 2.

46. *C. boyanum* spec. nova, affinis *C. stellenboschensi* Hodgetts, sed cellulis maioribus, minusque arcuatis et apice utroque poro praedito differt.

Near *C. stellenboschense* Hodgetts (W. J. Hodgetts, Trans. Roy. Soc. of S.A., Vol. XIII, 1926, p. 74, fig. 8); but the cells are larger and less curved, there is a pore at each apex. Cells of medium size, 7·3–7·4 times longer than their diameter, inner margin concave, slightly tumid in the median portion, gradually attenuated towards the apices, which are slightly acutely-rounded; cell wall smooth, straw-coloured or yellowish, with a pore at each apex; chloroplasts with about six ridges and a central series of five pyrenoids; terminal vacuoles large, with a number of moving granules. Length 167–174  $\mu$ ; breadth 23–24  $\mu$ . (Tab. 5, fig. 13.) Samples 57, 58, 64.

47. *C. caffrorum* spec. nova, affinis *C. cynthiae* De Not, sed cellulis multo minus arcuatis et polis hebetatis differt. Membrana cellulæ plus minusve 9 striis quae videri possunt ornata.



This species is near *C. cynthia* De Not (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 113, Pl. XI, figs. 1-3); but the cells are less curved and have truncate apices. Cells small, curved, inner margin concave, apices truncate; chloroplasts with six ridges and a central series of about four pyrenoids; cell wall yellowish-brown and striated, about nine striae being visible across the cell; terminal vacuoles with a single moving granule. Length 100-104  $\mu$ ; breadth 13.5-14  $\mu$ . (Tab. 8, fig. 4.) Sample 64.

48. *C. calosporum* Wittr. var. *minor* var. *nova*, a typo speciei cellulis multo minoribus ad apices hebetoto-rotundatis et minus curvatis differt.

These specimens differ from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 138, Pl. XVI, figs. 1-4) in having smaller cells, truncately-rounded apices and a smaller curvature. Cells about 7.7 times longer than their diameter; chloroplasts with a single series of about two pyrenoids. Length 54  $\mu$ ; breadth 7  $\mu$ . (Tab. 6, fig. 20.) Sample 3.

49. *C. ceratium* Perty var. *angustum* var. *nova*, a typo speciei cellulis multo angustioribus (cellula 49.1-56.1-plo longior quam latior) differt. Formae intermediae non visae.

Cells narrower than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 176, Pl. XXIII, figs. 6-8). Cells about 49.1-56.1 times longer than their diameter; straight for almost the whole length of the cell; chloroplasts with 11-12 pyrenoids. Length 123.5-124  $\mu$ ; breadth 2.2-2.5  $\mu$ . (Tab. 6, fig. 14.) Sample 3.

50. *C. cornu* Ehrenb. var. *minor* var. *nova*, a typo cellulis multo minoribus et poli minus acutis differt. Formae intermediae non visae.

Cells considerably smaller than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 157, Pl. XX, figs. 1-5), being about 13-17 times longer than their diameter; chloroplasts with about three pyrenoids. Length 64-74  $\mu$ ; breadth 4-5  $\mu$ ; breadth of apices 2.2-2.6  $\mu$ . (Tab. 6, fig. 23.) Sample 22.

51. *C. cornu* var. *angustum* var. *nova*, a var. *minori* Claassen cellulis paulo angustioribus et polis multo acutioribus differt.

Near var. *minor* Claassen; but the cells are narrower and the apices more acute. Cells 12.5-19 times longer than their diameter. Length 75-77  $\mu$ ; breadth 3.4-4  $\mu$ . (Tab. 6, fig. 24.) Sample 2.

52. *C. cymbellaeformis* spec. *nova*. Nulla affinitate obvia. Cellulae naviculares, margo ventralis tenuiter convexus apices hebetati, et membrana cellulae paulo incrassata.

Cells of medium size, boat-shaped, inner margin slightly convex, apices truncate with a slightly thickened cell wall; cell wall smooth and colourless; chloroplasts with about 10 ridges and a central series of four pyrenoids; subterminal vacuoles large, with a number of moving granules. Length 168-171.5  $\mu$ ; breadth 28-29  $\mu$ ; breadth of apices 8-10  $\mu$ . (Tab. 5, fig. 15.) Sample 2.

53. *C. cynthia* De Not var. *waterbergense* var. *nova*, differt a typo speciei cellulis minus arcuatis pauloque latioribus, polis minus acutis et membrana plus minusve 13 striis quae videri possunt ornata.

The cells are less curved than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 113, Pl. XI, figs. 1-3); they are slightly broader, the apices are less acute and the cell wall has about 13 striae visible across the cell. Inner margin slightly tumid; cell wall yellowish-brown; chloroplasts with about six ridges and a central series of four pyrenoids; terminal vacuoles with one moving granule. Length 115-119  $\mu$ ; breadth 18.5-20  $\mu$ . (Tab. 8, fig. 3.) Sample 64.

54. *C. decorum* Breb. var. *minor* var. nova, differt a typo cellulis multo minoribus et membrana striis 23–24 quae videri possunt disposita.

Cells considerably smaller than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 184, Pl. XVII, figs. 7, 8; Pl. XXVIII, figs. 1–3) and the cell wall with more striae. Cells of medium size, 10–14·6 times longer than their diameter, curvature somewhat variable, inner margin concave, slightly but broadly tumid in the median portion, gradually attenuated towards the apices, which are truncate; cell wall straw-coloured or yellowish-brown; each chloroplast with a central series of 6–11 pyrenoids. Length 176–292  $\mu$ ; breadth 17–20  $\mu$ ; breadth of apices 4–5  $\mu$ . (Tab. 5, fig. 12.) Samples 3, 63.

55. *C. ehrenbergii* Menegh. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 143, Pl. XVII, figs. 1–4.) Sample 42.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Belgium; Germany; Austria and Galicia; Bosnia in Hungary; Italy; Portugal; Norway; Sweden; Denmark; North, Central and South Russia; Faeroes; Central China; Japan; India; Siam; Samoa; New Zealand; Central Africa (var.); East Africa; United States; West Indies; Brazil; Uruguay; Patagonia; South Africa.

56. *C. ehrenbergii* var. *minutissimum* var. nova, affinis *C. ehrenbergii* Menegh., sed cellulis fere 5–7-plo minoribus, polis plus hebetatis, vacuolis terminalibus granulo singulo se moventi praeditis differt.

The cells are about 5–7 times smaller than in the typical form, the apices are more truncate and the terminal vacuoles have a single moving granule. Cells small, 4·1–4·8 times longer than their diameter; cell wall smooth and yellowish; chloroplasts with about six ridges and a central series of five pyrenoids. Length 75·5–77  $\mu$ ; breadth 16  $\mu$ ; breadth of apices 5–6  $\mu$ . (Tab. 6, fig. 21.) Sample 39.

57. *C. gracile* Breb. var. *brevius* var. nova, a typo speciei cellulis multo latoribus differt. Formae intermediae non visae.

Cells broader than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 166, Pl. XXI, figs. 8–12). Cells about 11–15·5 times longer than their diameter; chloroplasts with about six ridges and a single series of 4–6 pyrenoids; terminal vacuoles with one moving granule. Length 112–136  $\mu$ ; breadth 8·5–12  $\mu$ ; breadth of apices 2·2–3  $\mu$ . (Tab. 6, fig. 12.) Samples 51, 52, 54, 64.

58. *C. incurvum* Breb. var. *elaboratum* var. nova, a typo speciei cellulis minus arcuatis, polis minus acutis, vacuolis terminalibus singulo se moventi granulo praeditis differt.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 136, Pl. XV, figs. 28–30) in the smaller curvature of the cells, in the terminal vacuoles containing only one moving granule and in the less acute apices. Cells 4·5–6 times longer than their diameter, apices acutely rounded; chloroplasts with six ridges and a central series of two pyrenoids. Length 51–52  $\mu$ ; breadth 8·5–11  $\mu$ ; breadth of apices 1·5–2·5  $\mu$ . (Tab. 6, fig. 19.) Samples 58, 59, 63.

59. *C. insolitum* spec. nova. Nulla affinitate obvia. Cellulae solum plus minusve 2·8-plo longiores quam latiores, valide arcuatae ad apices rotundatae, membrana aethroa glabraque. Chromatophora binis seriebus 2 vel 3 pyrenoidorum ornata.

This differs from other species of *Closterium* in the cells being rather broad in proportion to their length. Cells of medium size, about 2·8 times longer than their diameter, strongly curved, apices rounded; cell wall smooth and colourless; chloroplasts with about four ridges and two series of 2–3 pyrenoids each. Length 124  $\mu$ ; breadth 44  $\mu$ . (Tab. 8, fig. 5.) Sample 39.

60. *C. intermedium* Ralfs var. *mesianum* var. nova, affinis *C. intermedio* var. *hibernico* West, sed polis non valde arcuatis, membrana cellulae glabra et achroa (quae colore caret) differt.

This superficially resembles *C. intermedium* var. *hibernicum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 126, Pl. XIV, fig. 6); but the poles are less incurved; cell wall smooth and colourless and the cells are considerably longer than in West's variety. Cells of medium size, about 19–22·7 times longer than their diameter, moderately curved, inner margin straight in the median portion, gradually attenuated towards the apices, which are truncate and slightly incurved; chloroplasts with about eight ridges, and 12–13 pyrenoids in one axile series; terminal vacuoles with a number of moving granules. Length 324–364  $\mu$ ; breadth 16–18  $\mu$ ; breadth of apices 4  $\mu$ . (Tab. 4, fig. 3.) Sample 44.

Named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

61. *C. jenneri* Ralfs. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 134, Pl. XV, figs. 23–25.) Sample 27.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Galicia; Hungary; Italy; Spain; Norway; Sweden; Bornholm; North and South Russia; Faeroes; Nova Zembla; Greenland; Siam; Java; Central and East Africa; Azores; United States; Brazil; Switzerland; South Africa.

62. *C. jenneri* var. *dubitabilis* var. nova, affinis *C. jenneri* var. *robusto* G. S. West, sed cellulis minus arcuatis differt.

This is near *C. jenneri* var. *robustum* G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 136, Pl. XV, figs. 26, 27); but the cells are less curved than in West's variety. Cells small, about 6·5–7·4 times longer than their diameter; cell wall smooth and yellowish-brown; chloroplasts with about six ridges and five pyrenoids; terminal vacuoles with 1–2 moving granules. Length 84–86  $\mu$ ; breadth 11·5–13  $\mu$ ; breadth of apices 5–6  $\mu$ . (Tab. 6, fig. 7.) Sample 3.

63. *C. kranskopense* spec. nova. Prima facie forma cellulae plus minusve *C. cornu* Ehrenb. congruens, sed cellulis 7-plo maioribus, membrana luteo-brunea apicem versus incrassata et plus minusve 60 striis disposita differt.

The shape of the cell (low magnification) agrees with that of *C. cornu* Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 157, Pl. XX, figs. 1–5); but the cells are about seven times as large as those in Ehrenberg's species; the cell wall is yellowish-brown and striated, with about 60 striae visible across the cell, and the cell walls are thickened at the apices. Cells large, 15–16 times longer than their diameter, moderately curved, inner margin concave, gradually attenuated towards the apices, which are truncate rounded; cell wall with a distinct thickening at each apex; chloroplasts with about six ridges, and a central series of 14–23 pyrenoids; terminal vacuoles with a number of moving granules. Length 765–854  $\mu$ ; breadth 52–54·5  $\mu$ . (Tab. 4, figs. 4, 5.) Sample 61.

64. *C. kützingii* Bréb. var. *transvaalense* var. nova, a typo speciei differt quod cellulae media pars multo longius est incrassata.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 186, Pl. XXV, figs. 6–11) in the cells being tumid in the median part for a greater distance. Cells about 24 times longer than their diameter; about 16 striae visible across the cell. Length 336  $\mu$ ; breadth 14  $\mu$ ; breadth of apices 3  $\mu$ . (Tab. 6, fig. 1.) Sample 3.

65. *C. malinvernianum* De Not. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 145, Pl. XVII, figs. 5, 6.) Up to 68 striae visible across the cell. Figs. 9–11 are cells soon after division. (Tab. 4, figs. 8–11.) Samples 51, 52, 53, 54, 57, 58.



*Geographical Distribution*.—England; Scotland; Ireland; Austria and Galicia; Italy; Spain; Norway; Sweden; South Africa.

66. *C. moniliferum* (Bory) Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 142, Pl. XVI, figs. 15, 16.) Samples 4, 6, 14.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Belgium; Germany; Switzerland; Galicia in Austria; Hungary and Bosnia; Italy; Portugal; Norway; Sweden; Denmark; Bornholm; North and South Russia; Poland; Faeroes; Iceland; China; Japan; Ceylon; New Zealand; Central Africa; United States; Brazil; Argentina; Uruguay; Patagonia; South Africa.

67. *C. moniliferum* var. *epithemioides* var. nova, a typo speciei margine ventrali medio minus tumido, membrana straminea et cellulis plerumque paulo minoribus differt.

Inner margin slightly but broadly tumid; cell wall straw-coloured; cells usually somewhat smaller than in the typical form. Cells 5–7 times longer than their diameter; chloroplasts with about eight ridges and a central series of 5–6 pyrenoids. Length 184–240  $\mu$ ; breadth 34–38  $\mu$ ; breadth of apices 6–8  $\mu$ . (Tab. 5, fig. 14.) Samples 13, 14, 15.

68. *C. parvulum* Näg. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 133, Pl. XV, figs. 9–12.) Sample 32.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Switzerland; Austria; Galicia; Hungary; Spain; Norway; Sweden; Denmark; Finland; North, South and Central Russia; Nova Zembla; Greenland; Siberia; Japan; Ceylon; Siam; Sumatra; Java; Samoa; Australia; Central and East Africa; United States; Brazil; Ecuador; Patagonia; South Africa.

69. *C. parvulum* var. *minor* var. nova, a typo speciei cellulis multo minoribus et apicibus aliquanto plus hebetatis differt. Formae intermediae haud visae.

Cells smaller and apices more truncate than in the typical form. Length 76–76.5  $\mu$ ; breadth 7–8  $\mu$ ; breadth of apices 3–4  $\mu$ . (Tab. 6, fig. 8.) Sample 3.

70. *C. peracerosum* Gay var. *elegans* G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 155, Pl. XIX, figs. 12, 13.) Ventral margin in the median portion of the cell slightly more tumid than in the typical form, and the cells are shorter. Length 134–172  $\mu$ ; breadth 9–15  $\mu$ . (Tab. 6, fig. 11.) Samples 13, 14, 15. *Geographical Distribution*.—England; First record for South Africa.

71. *C. praelongum* Bréb. forma *brevior* West. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 165, Pl. XXI, figs. 3–5.) Cell wall yellowish and punctate. Sample 6.

*Geographical Distribution*.—England; Scotland; Ireland; Portugal; Sweden; New Zealand; South Africa.

72. *C. pritchardianum* Arch. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 172, Pl. XXII, figs. 6–14.) These specimens are generally larger than the typical form. Length 496–825  $\mu$ ; breadth 48–58  $\mu$ ; breadth of apices 5–7  $\mu$ . Samples 6, 42.

*Geographical Distribution*.—England; Scotland; Ireland; France; Germany; Austria and Galicia; Italy; Norway; Sweden; North Russia; China; Brazil; Argentina; Switzerland; South Africa.

73. *C. pseudoleibleinii* spec. nova, affinis *C. leibleinii* Kütz., sed differt èt cellulis non tantopere curvatis èt polis hebetatis èt quod tumor in medio margine ventrali minor est. Membrana cellulæ iuxta ante apices in marginibus ventrali dorsalique incrassata.



This species comes near *C. leibleinii* Kütz. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 141, Pl. XVI, figs. 9–14); but the cells are less curved, with truncate apices and the ventral margin less tumid; the cell wall has an annular thickening at each apex. Cells of medium size, about 10·5 times longer than their diameter; cell wall smooth and yellowish-brown; the chloroplast has about six ridges and a central series of 6–8 pyrenoids; terminal vacuoles with one large moving granule. Length 231·5  $\mu$ ; breadth 21·5  $\mu$ ; breadth of apices 8·5  $\mu$ . (Tab. 5, fig. 8.) Sample 24.

74. *C. pseudolumula* spec. nova, affinis *C. lunulae* (Müll.) Nitzsch, sed apicibus cellulae hebetatis et minus recurvatis, etiam cellulis angustioribus differt.

Near *C. lunula* (Müll.) Nitzsch (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 150, Pl. XVIII, figs. 8, 9), but the apices of the cells are truncate and less recurved and the cells are narrower and shorter. Cells of medium size, about 7–8 times longer than their diameter, straight, inner margin fairly straight or slightly tumid in the median part of the cell, gradually attenuated towards the apices, which are truncately rounded; cell wall smooth and colourless; each chloroplast with about 10 ridges and numerous scattered pyrenoids; terminal vacuoles large, with a number of moving granules. Length 372–412  $\mu$ ; breadth 51·5–58  $\mu$ ; breadth of apices 14–16  $\mu$ . (Tab. 4, fig. 1.) Samples 34, 35.

75. *C. ralfsii* Bréb. var. *subralfsii* var. nova, affinis *C. ralfsii* var. *hybrido* Rabenh., sed differt et cellulis minus arcuatis, et quod margo ventralis in media cellula inercassatus non est; et membrana 25–30 striis, chromatophoraque 11–16 pyrenoidibus minoribus instructa differt.

Near *C. ralfsii* var. *hybridum* Rabenh. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 183, Pl. XXIV, figs. 8–13); but the cells are less curved, and are without a median inflation; 25–30 striae visible across the cell; chloroplasts with a median series of 11–16 small pyrenoids. Cells of medium size, 9–13 times longer than their diameter, apices truncately rounded; cell wall yellowish-brown; chloroplasts with about six ridges; terminal vacuoles with a number of moving granules. Length 314–424  $\mu$ ; breadth 34–38  $\mu$ ; breadth of apices 8–10  $\mu$ . (Tab. 5, fig. 1.) Samples 34, 35.

76. *C. ralfsii* var. *glentigianum* var. nova, affinis var. *subralfsii* Claassen, sed membrana cellulae 32–34 striis et chromatophora 5–7 pyrenoidibus magnis instructa differt.

Cell wall with 32–34 striae across the cell; chloroplasts with a series of 5–7 large pyrenoids. Apices slightly obliquely-rounded. Length 322–344  $\mu$ ; breadth 35–36  $\mu$ ; breadth of apices 9–10  $\mu$ . (Tab. 5, fig. 2.) Sample 46.

77. *C. ralfsii* var. *minor* var. nova, a typo speciei cellulis multo minoribus differt. Membrana cellulae 21–23 striis et chromatophora 10–12 pyrenoidibus instructa. Formae intermediae haud visae.

Cells considerably smaller than in the typical form. Cells of medium size, 7–10 times longer than their diameter, moderately curved, inner margin concave. Cell wall yellowish-brown, striated, 21–23 striae visible across the cell; chloroplasts with 10–12 pyrenoids. Length 202–264  $\mu$ ; breadth 26–32  $\mu$ ; breadth of apices 8–10  $\mu$ . (Tab. 5, figs. 4–5.) Sample 3.

78. *C. ralfsii* var. *nodosum* var. nova, affinis *C. ralfsii* var. *hybrido* Rabenh. sec. Fukushima et Fujisawa, sed differt et polis leviter capitatis et quod plus minusve 18 striis, quae videri possunt, membrana distincta est.

This is near *C. ralfsii* var. *hybridum* Rabenh. sec. Fukushima & Fujisawa (H. Fukushima and the late K. Fujisawa, Desmids Flora of Oze. Reprinted from Scientific Researches of the Ozegahara Moor. Tokyo, 1954, p. 596, Pl. I, figs. L–M.); but the apices are slightly clavate and about 18 striae are visible across the cell. Cells of medium size, 8·6–8·8 times longer than their diameter, curved, inner margin concave and

straight in the median portion, gradually attenuated towards the apices; cell wall yellowish-brown; chloroplasts with about 12 ridges and a central series of 12–13 pyrenoids; terminal vacuoles with a number of moving granules. Length 306–310  $\mu$ ; breadth 35–35.5  $\mu$ ; breadth of apices 12–12.5  $\mu$ . (Tab. 5, fig. 3.) Sample 42.

79. *C. rostratum* Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 188, Pl. XXVI, figs. 1–5.) Some specimens are slightly narrower (17  $\mu$ ) than in the typical form. Sample 21.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Italy; Portugal; Norway; Sweden; Bornholm; Poland; North, Central and South Russia; Finland; Faeroes; Iceland; Nova Zembla; Greenland; Siberia; Japan; Ceylon (form); East Africa; United States; Brazil; Ecuador; Paraguay; Switzerland; South Africa.

80. *C. schweickerdtii* spec. nova, affinis *C. stellenboschensi* Hodgetts, sed cellulis multo maioribus et magis arcuatis, polisque acutioribus differt. Apex uterque poro vacuolaeque terminales paucis granulis se moventibus praeditae.

Near *C. stellenboschense* Hodgetts (W. J. Hodgetts, Trans. Roy. Soc. of S.A., Vol. XIII, 1926, p. 74, fig. 8); but the cells are considerably larger, the apices are more acute and the cells are strongly curved; each apex furnished with a pore; terminal vacuoles with a number of moving granules. Cells of medium size, about 6.8–8.5 times longer than their diameter, inner margin tumid in the median portion, gradually attenuated towards the apices, which are somewhat acute; cell wall smooth and colourless; chloroplasts with about eight ridges and a series of 5–9 pyrenoids; terminal vacuoles with 4–5 large moving granules. Length 170–186  $\mu$ ; breadth 20–26  $\mu$ . (Tab. 5, fig. 18.) Samples 42, 44.

Named after Prof. Dr. H. G. Schweickerdt, Head of the Department of General Botany, University of Pretoria.

81. *C. spetsbergense* Borge var. *subafricanum* var. nova, affinis *C. spetsbergensi* var. *africano* Fritsch et Rich, sed differt et forma polorum et quod membrana cellulae striata est. Cellulae multo minores sunt; striarum dispositio cum *C. pritchardiano* Arch. valde congruit.

This is near *C. spetsbergense* Borge var. *africanum* Fritsch & Rich (F. E. Fritsch & F. Rich, Trans. Roy. Soc. of S.A., Vol. XVIII, 1930, p. 57, fig. 16C–G); but the shape of the apices is different, the cells are considerably smaller, and the cell wall is striated: striae similar to those found in *C. pritchardianum* Arch. Cells about 7–11 times longer than their diameter; cell wall yellowish or yellowish-brown, 35–40 striae visible across the cell; striae composed of fine punctae; chloroplasts with 6–10 ridges, and a central series of 4–9 pyrenoids; terminal vacuoles with a number of moving granules. Length 238–394  $\mu$ ; breadth 34–52  $\mu$ ; breadth of apices 5–6  $\mu$ . (Tab. 4, fig. 2.) Samples 13, 14, 15.

82. *C. striolatum* Ehrenb. var. *nylstromicum* var. nova, a typo cellulis brevioribus et 7–8-plo longioribus quam latioribus, polis plus hebetatis, membrana ad apices leviter incrassata et 13–18 striis praedita differt.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 122, Pl. XIII, figs. 7–16) in having shorter cells (about 7–8 times longer than their diameter) with blunter apices; cell wall slightly thickened at the apices, yellowish-brown, with 13–18 striae visible across the cell. Length 192–220  $\mu$ ; breadth 26–32  $\mu$ ; breadth of apices 12  $\mu$ . (Tab. 5, fig. 9.) Samples 34, 35.

83. *C. striolatum* var. *subnylstromicum* var. nova, affinis var. *nylstromico* Claassen, sed differt striis inter se plus approximatis, plus minusve 19 in membrana dispositis, quae ad apices est incrassata.

Cells of medium size, about 7·5 times longer than their diameter, slightly curved, gradually attenuated towards the apices, which are obtusely-rounded; cell wall yellowish-brown, striated, with 19 striae visible across the cell; each chloroplast with 6–7 pyrenoids; terminal vacuoles with one large moving granule. Length 191  $\mu$ ; breadth 25  $\mu$ ; breadth of apices 12  $\mu$ . (Tab. 5, fig. 10.) Sample 54.

84. *C. subdecorum* spec. nova, affinis *C. decoro* Bréb., sed cellulis multo minoribus, margine ventrali pro parte maiore tumido, membrana striis carenti differt.

This is near *C. decorum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 184, Pl. XVII, figs. 7, 8; Pl. XXVIII, figs. 1–3), but the cells are considerably smaller, the inner margin of the cell is tumid for a longer distance and the cell wall is smooth. Cells of medium size, about 10·4–10·7 times longer than their diameter, curved, gradually attenuated towards the apices, which are obtusely-rounded; cell wall smooth and colourless; chloroplasts with a central series of three pyrenoids; terminal vacuoles with a number of moving granules. Length 203·5–208  $\mu$ ; breadth of apices 3·5–4  $\mu$ . (Tab. 5, fig. 11.) Sample 2.

85. *C. sublagoense* spec. nova, affinis *C. lagoensi* Nordst., sed cellulis angustioribus, forma poli et margine ventrali medio incrassato differt.

This species is near *C. lagoense* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 114, Pl. XI, figs. 5–7); but the cells are narrower, the shape of the apices differs and the inner margin is tumid in the median portion. Cells small, 7·5–8·5 times longer than their diameter, strongly curved, gradually attenuated towards the apices, which are somewhat acutely rounded; cell wall yellowish, striated, with about 11 striae visible across the cell. Length 160–168  $\mu$ ; breadth 20–21  $\mu$ . (Tab. 5, fig. 17.) Sample 12.

86. *C. subsiliqua* spec. nova, affinis *C. siliqua* W. et G. S. West, sed cellulis haud curvatis, margine ventrali recto, vel in media cellula leviter incrassata differt.

This somewhat resembles *C. siliqua* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 154, Pl. XIX, figs. 6–8); but the cells are straight. Cells of medium size, about 8·9–4 times longer than their diameter, more or less straight, inner margin straight or slightly tumid in the median portion, gradually attenuated towards the apices, which are slightly acute, and recurved in some specimens; cell wall smooth and colourless or straw-coloured; chloroplasts with about 10 ridges and a central series of 7–11 pyrenoids; terminal vacuoles with one large moving granule. Length 227–264  $\mu$ ; breadth 26–32  $\mu$ ; breadth of apices 3–6  $\mu$ . (Tab. 5, fig. 7.) Samples 13, 14, 15.

87. *C. truncatum* spec. nova. Nulla affinitate notata. Cellulae plus minusve 6·2-plo longiores quam latiores. Margo ventralis in media cellula leviter incrassatus; poli hebetati. Membrana glabra, subflava et apicem versus leviter incrassata.

Cells of medium size, about 6·2 times longer than their diameter, slightly curved, inner margin somewhat concave, with the median portion slightly tumid, gradually attenuated towards the apices, which are truncate; cell wall smooth, yellowish and with a thickening at the apices; chloroplasts with about 10 ridges and a central series of four pyrenoids; terminal vacuoles large, with a number of moving granules. Length 224–225·5  $\mu$ ; breadth 36  $\mu$ ; breadth of apices 8–8·5  $\mu$ . (Tab. 5, fig. 6.) Sample 21.

88. *C. tumidum* Johnson. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 156, Pl. XIX, figs. 15–18.) Cells up to 9·9–13 times longer than their diameter. Length 102–114  $\mu$ ; breadth 9–10·5  $\mu$ ; breadth of apices 2·5–3  $\mu$ . (Tab. 6, fig. 15.) Sample 9.

*Geographical Distribution.*—England; Wales; Scotland; Norway; Nova Zembla; Siam; Celebes; Samoa; United States; Brazil; Paraguay; Patagonia; Japan; South Africa.



89. *C. tumidum* var. *angustum* var. nova, a typo speciei cellulis multo angustioribus et minus arcuatis differt. Cellula 15·5–22-plo longior quam latior.

Cells narrower than in the typical form, being about 15·5–22 times longer than their diameter, and less curved. Chloroplasts with about nine pyrenoids. Length 108–132  $\mu$ ; breadth 6–8  $\mu$ ; breadth of apices 1–1·3  $\mu$ . (Tab. 6, fig. 13.) Sample 3.

90. *C. venus* Kütz. (W. & G. S. West, Monogr. Brit. Desm., Vol. I. 1904, p. 137, Pl. XV, figs. 15–20.) Samples 4, 9, 21.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Italy; Norway; Sweden; North Russia; Faeroes; Nova Zembla; Greenland; Siberia; Central China; Japan; Ceylon; Burma; Siam; New Zealand; Central Africa; Azores; United States; Brazil; Patagonia; Switzerland; South Africa.

91. *C. venus* var. *inflatum* var. nova, a typo speciei differt quod margo ventralis cellulae media in parte leviter inflatus, membranaeque achroa est vel subflava.

This differs from the typical form in that the inner margin is slightly tumid. Cells about 6·8–7·1 times longer than their diameter; cell wall smooth and colourless or yellowish; each chloroplast with a central series of two pyrenoids; terminal vacuoles with 1–2 moving granules. Length 68–70  $\mu$ ; breadth 9–10  $\mu$ ; breadth of apices 1·5–2·5  $\mu$ . (Tab. 6, figs. 16–18.) Samples 6, 11.

92. *C. warmbadianum* spec. nova, affinis *C. spinosporo* Hodgetts, sed cellulis brevioribus latioribusque, membrana cellulae ad apices non incrassata sed in medio margine ventrali leviter incrassata differt. Vacuolae terminales granulis paucis globosis seque moventibus praeditae.

Near *C. spinosporum* Hodgetts (W. J. Hodgetts, Trans. Roy. Soc. of S.A., Vol. XIII, 1926, p. 72, fig. 7A–B); but the cells are shorter and broader, the inner margin is slightly tumid in the median portion. The apices are without a cell wall thickening; and the terminal vacuoles are large, with a number of spherical moving granules. Cells small, 6·5–8 times longer than their diameter, curved, gradually attenuated towards the apices, which are slightly acutely rounded; cell wall smooth and colourless; chloroplasts with about eight ridges and 2–5 pyrenoids. Length 104–118  $\mu$ ; breadth 14–18  $\mu$ . (Tab. 6, fig. 2.) Samples 51, 52, 53, 54.

93. *C. warmbadianum* var. *porulosum* var. nova, a typo speciei differt quod apex uterque poro est praeditis et vacuolae terminales granula aliquot maiora, elongata, se moventia habent.

Each apex with a pore in the cell wall; terminal vacuoles with a number of large oblong moving granules. Cell wall colourless or yellowish-brown; chloroplasts with about six ridges and 3–4 pyrenoids. Length 104–120  $\mu$ ; breadth 12–15  $\mu$ . (Tab. 6, fig. 3.) Samples 58, 63, 64.

#### *Pleurotaenium* Näg.

94. *P. cafferorum* spec. nova, affinis *P. basiundato* W. et G. S. West, sed semicellulis iuxta tumorem basalem unica undulatione praeditis differt.

This comes near *P. basiundatum* W. & G. S. West (W. & G. S. West, Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 5, fig. 35); but the semicells have a single small undulation above the basal inflation. Cells of medium size, cylindrical, 25·8–30 times longer than their diameter; semicells gradually attenuated from base to apex, with a distinct basal inflation and a smaller undulation above it; apices obtusely rounded, bordered by a ring of tubercles, eight in number (four visible across the apex); cell wall punctate. Length 400–482  $\mu$ ; breadth at base of semicells 20  $\mu$ , at middle of semicells 15·5–16  $\mu$ , at apices 14·4–15  $\mu$ . (Tab. 7, fig. 6.) Sample 20.



95. *P. ehrenbergii* (Bréb.) De Bary. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 205, Pl. XXIX, figs. 9–11; Pl. XXX, fig. 1.) Sample 20.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Italy; Norway; Denmark; Bornholm; Poland; North Russia; Nova Zembla; Siberia; Central China; India; Ceylon; Java; Sumatra; Samoa; Australia; New Zealand; Madagascar; East and West Africa; United States; Brazil; Patagonia; Japan; Switzerland; South Africa.

96. *P. ehrenbergii* var. *waterbergense* var. nova, affinis *P. ehrenbergii* var. *undulato* Schaarschm., sed differt et membrana luteo-fulva et quod semicellulis iuxta tumorem basalem undulatio aut deest aut vix perspicui potest.

Near *P. ehrenbergii* var. *undulatum* Schaarschm. (W. & G. S. West, The Freshwater Algae of Ceylon, Trans. Linn. Soc. London, Ser. 2, Vol. VI, 1901–1902, Pl. 18, fig. 28); but the semicells are without or with one very slight undulation above the basal inflation, cell wall yellowish-brown. Cells of medium size, 10·7–11·4 times longer than their diameter; semicells gradually attenuated from base to apex; apices bordered by a ring of pear-shaped tubercles, 4–8 in number (three or five visible across the apex); cell wall punctate. Length 416–428  $\mu$ ; breadth at base of semicells 36·4–41  $\mu$ , at middle of semicells 36–36·5  $\mu$ , at apices 26–29  $\mu$ . (Tab. 7, figs. 7, 8.) Sample 22.

97. *P. maximum* (Reinsch) Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 213, Pl. XXXI, figs. 1, 2.) Sample 61.

*Geographical Distribution*.—Wales; Scotland; France; Germany; Italy; Austria and Galicia; Hungary; Sweden; Japan (var.); Ceylon; Siam; Abyssinia; West Africa; Brazil; Ecuador (var.); Paraguay; Uruguay; South Africa.

98. *Pleurotaenium* species ad *P. ovatum* Nordst. Cells of medium size; 3·8–4 times longer than their diameter; semicells tumid, a little broader at the middle than at the base, attenuated from the middle to the apices, without a basal inflation; apices with one or two rings of tubercles, outer ring with 6–10 tubercles (4–6 visible across the apex) and the inner ring with 6–8 (3–4 visible across the cell); cell wall punctate. Length 313–356  $\mu$ ; breadth 83–90  $\mu$ ; breadth of isthmus 44–60  $\mu$ ; breadth of apices 25–28  $\mu$ . (Tab. 8, figs. 1, 2.) Samples 20, 42.

Since only the description of *P. ovatum* Nordst. was available, it is impossible to decide with certainty whether these specimens really belong to Nordstedt's species.

99. *P. pseudoehrenbergii* spec. nova, affinis *P. ehrenbergii* (Bréb.) De Bary, sed membrana glabra, apice utrinque tuberculo uno ornato, cellula iuxta tumorem basalem vix undulata differt.

This species is near *P. ehrenbergii* (Bréb.) De Bary (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 205, Pl. XXIX, figs. 9–11; Pl. XXX, fig. 1); but the undulation above the basal inflation is very slight, there is one tubercle on each side of the apex, and the cell wall is smooth. Cells of medium size, subcylindrical, 12·4–12·5 times longer than their diameter; semicells with one distinct basal inflation and a small undulation above it, gradually attenuated towards the apices or slightly tumid and then gradually attenuated towards the apices; apices truncate, furnished with two tubercles. Length 408–448  $\mu$ ; breadth at base of semicells 31–34  $\mu$ , at middle of semicells 32–36  $\mu$ , at apices 24–26·5  $\mu$ . (Tab. 7, fig. 2.) Sample 24.

100. *P. trabecula* (Ehrenb.) Näg. var. *angustum* var. nova, a typo speciei cellulis multo angustioribus differt. Cellulae plus minusve 25·5–28·3-plo longiores quam latiores.

Cells narrower in proportion to their length than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 209, Pl. XXX, figs. 11–13); cells 25·5–28·3 times longer than their diameter. Apices obtusely rounded, without tubercles; cell wall punctate. Length 514–568  $\mu$ ; breadth at base of semicell 24–24·5  $\mu$ , at middle of semicell 20–21  $\mu$ , at the apices 16–19  $\mu$ . (Tab. 7, figs. 3–5.) Samples, 59, 60.

101. *P. trabecula* var. *barbaricum* var. nova, affinis *P. trabeculae* var. *recto* (Delp.) W. et G. S. West, sed differt quod apex cellulae circulo 6 tuberculorum instructus est, cellulae 14·9–16-plo longioribus quam latioribus, at quam variationis *rectum* (Delp.) W. et G. S. West paulo latiores sunt.

This closely resembles *P. trabecula* var. *rectum* (Delp.) W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 212, Pl. XXX, figs. 9, 10); but the cells are a little broader and the apices tuberculate. Cells of medium size, rather narrow and subcylindrical; semicells somewhat variable in shape, attenuated from base to apex or slightly tumid and then gradually attenuated to the apices, with a distinct basal inflation and one small undulation immediately above it; apices truncate, bordered by a ring of conical tubercles, six in number (four visible across the apex); cell wall smooth. Length 402·5–420  $\mu$ ; breadth at base of semicells 27–28  $\mu$ , at middle of semicells 23–27  $\mu$ , at apices 18–20  $\mu$ . (Tab. 7, fig. 1.) Sample 61.

102. *P. trabecula* var. *brevis* var. nova, a typo speciei cellulis valde brevioribus et apicibus tuberculis ornatis differt.

Cells shorter than in the typical form, apices with one tubercle. Length 359  $\mu$ ; breadth at base of semicell 28–28·5  $\mu$ , at middle of semicells 26–27·5  $\mu$ , and at apices 19–20  $\mu$ . (Tab. 7, fig. 10.) Sample 35.

103. *P. trochiscum* W. & G. S. West var. *galpinii* var. nova, a typo cellulis multo brevioribus et 7·2–8-plo longioribus quam latioribus, margine apicali circulo tuberculorum fere 8 ornato differt.

The cells are considerably shorter than in the typical form (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 13, figs. 4, 5), and are about 7·2–8 times longer than their diameter; apices bordered by a ring of tubercles, about eight in number (five visible across the apex). Length 252–264  $\mu$ ; breadth at base of semicell 33–35  $\mu$ , at middle of semicell 30–32  $\mu$ , at apices 20–23  $\mu$ . (Tab. 8, fig. 7.) Sample 71.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

104. *P. truncatum* (Bréb.) Näg. var. *mattiei* var. nova, affinis *P. truncato* var. *granulato* West, sed cellulis multo brevioribus, semicellulis media in parte minus tumidis, margine apicali tuberculis paucioribus ornato differt.

Near *P. truncatum* var. *granulatum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 205, Pl. XXIX, figs. 7, 8); but the cells are much shorter, they are less tumid in the median part of the semicells and the apical margin has fewer tubercles. Cells small, about 7–7·2 times longer than their diameter; semicells with one basal inflation, slightly tumid in the middle of the semicells; apices bordered by a ring of tubercles, 2–4 in number (2–3 visible across the apex); cell wall punctate. Length 272  $\mu$ ; breadth at base of semicell 36  $\mu$ , at middle of semicell 38–39  $\mu$ , at apices 26–28  $\mu$ . (Tab. 8, fig. 6.) Sample 21.

105. *P. westiorum* spec. nova, affinis *P. monilifero* W. et G. S. West, sed apicibus cellulae multo latioribus (modo non tam latis quam ad semicellulae basim) differt.

This is near *P. moniliferum* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 5, fig. 32); but with broader apices (about as broad as at the base of the semicells). Cells large, 16–16·5 times longer than their diameter; semicells slightly tumid in the middle, with a slight basal inflation and two smaller undulations above it; apices truncate, and bordered by a ring of pear-shaped tubercles, 24 in number (13 visible across the apex); cell wall smooth. Length 796–800  $\mu$ ; breadth at base of semicells 48–50  $\mu$ , near base of semicells 44–46  $\mu$ , at middle of semicells 48–50  $\mu$ , near apices 40–44·5  $\mu$ , at apices 44–47  $\mu$ . (Tab. 7, fig. 9.) Sample 1.

Named after Messrs. W. & G. S. West.

*Tetmemorus Ralfs*

106. *T. laevis* (Kütz.) Ralfs. (W. & G. S. West, Monogr. Brit. Desm., Vol. I, 1904, p. 222, Pl. XXXII, figs. 11–16.) Sample 2.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Belgium; Germany; Austria and Galicia; Italy; Norway; Sweden; Denmark; Bornholm; North and South Russia; Nova Zembla; Greenland; Singapore; Australia; New Zealand; Sandwich Islands; Azores; Dominica and Trinidad; West India; Brazil; Japan; Central Africa; Switzerland; United States; South Africa.

*Euastrum Ehrenberg*

107. *E. ansatum* Ralfs. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 27, Pl. XXXVI, figs. 10–13.) Fig. 8 shows a cell with dividing pyrenoids. (Tab. 9, fig. 8.) Samples, 3, 25, 34, 35, 36, 54, 56.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Belgium; Germany; Austria and Galicia; Hungary; Italy; Norway; Sweden; Denmark; Bornholm; Finland; North and South Russia; Faeroes; Iceland; Greenland; Central China; Japan; India; Ceylon; Burma (var.); Siam; Singapore; Sumatra; Java; Australia (form); New Zealand; Madagascar; East Africa; Azores; Sandwich Islands; United States; West Indies (var.); Brazil; Paraguay; Switzerland; South Africa.

108. *E. brasiliense* Borge var. *theronii* var. nova, affinis *E. brasiliensi* var. *africanum* Fritsch et Rich, sed cellularum a latere visarum forma differt quoniam semicellulae gradatim a basi apicem versus in cuneum deplanantur, neque tuberculi apparent.

This variety closely resembles *E. brasiliense* var. *africanum* Fritsch & Rich (F. E. Fritsch & F. Rich, Trans. Roy. Soc. of S.A., Vol. XI—Part 4, 1924, p. 330, fig. 9); but the shape of its semicells differs in being gradually attenuated from base to apex when seen in lateral view and the cells are slightly smaller. Cells of medium size, about 3–3.4 times longer than broad, deeply constricted; sinus narrowly linear, open towards the extremity; semicells pyramidal, basal angles rounded, lower part of lateral margins convex, upper part slightly concave; apex truncate with rounded angles, median incision not very deep; semicells tumid above the isthmus. Side view of semicell elongate-pyramidal; cell wall punctate. Length 107–108  $\mu$ ; breadth 32–35  $\mu$ ; breadth of isthmus 16–18  $\mu$ ; breadth of apex 22–23  $\mu$ . (Tab. 9, figs. 6, 7.) Sample 42.

Named after Mr. J. E. Theron of Rietfontein 288, Nylstroom.

109. *E. cuneatum* Jenner var. *minor* var. nova, cum typo speciei valde congruens, sed cellulis multo minoribus et incisura apicali multo angustiore bene distincta. Formae intermediae haud visae.

Cells much smaller than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 25, Pl. XXXVI, fig. 9) and the apical incision is narrower. Cell wall finely punctate. Length 64–68  $\mu$ ; breadth 25–27  $\mu$ ; breadth of isthmus 9–12  $\mu$ ; thickness 20  $\mu$ . (Tab. 9, figs. 13, 14.) Sample 3.

110. *E. denticulatum* (Kirchn.) Gay. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 56, Pl. XXXIX, figs. 1–4.) Sample 24.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Galicia and Austria; Norway; Sweden; Bornholm; Finland; North Russia (var.); Iceland; Greenland; Central China; Ceylon; Siam; Singapore; Java; Australia (var.); New Zealand; Madagascar (var.); East and Central Africa; Azores; United States; West Indies; Brazil (var.); South Africa.



111. *E. divaricatum* Lund. var. *transvaalense* var. nova, cum typo speciei plus minusve congruens, sed paulo major; lobus apicalis dentibus duobus parvis, lobis lateralis infimus dentibus 3 parvis munitus. A latere visus processus supra isthmum glaber singularisque, sed a vertice bipartitus videtur.

The cells are slightly larger than in the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 42, Pl. XXXVIII, figs. 3, 4). Lower lateral lobules with three teeth and upper lobules with two teeth each; protuberance in each semicell above the isthmus single in lateral view and bilobulate in vertical view. Length  $52\ \mu$ ; breadth  $36\ \mu$  (with teeth  $41\ \mu$ ); breadth of isthmus  $8-9\ \mu$ ; breadth of apex  $20\ \mu$ . (Tab. 24, figs. 1-3.) Sample 39.

112. *E. divergens* Joshua var. *subbifidum* var. nova, affinis *E. divergenti* var. *bifido* Schmidle, sed praecipue forma lobi polaris et cellulis multo minoribus differt.

This variety has a greater resemblance to var. *bifidum* Schmidle (W. Schmidle, Engler Botan. Jahrb., Vol. 26, 1899, p. 44, Taf. II, fig. 34) than to Joshua's species (W. Joshua, Burmese Desmidiaceae, Journ. Linn. Soc. Bot., Vol. XXI, p. 640, Pl. 23, figs. 8, 9). However, it differs from Schmidle's variety in having relatively smaller cells and in the shape of the polar lobes. Cells small, about 1.2 times longer than broad, deeply constricted; sinus narrowly linear; semicells deeply 3-lobed; granules above central inflation in concentric arrangement; lateral lobes semifusiform, ends truncate, upper part of lobes elongated, lobes ornate with granules; polar lobe quadrate in lower part and widening at the apex. Length  $44-50\ \mu$ ; breadth  $36-42\ \mu$ ; breadth of isthmus  $10-12\ \mu$ ; maximum breadth of polar lobe  $20\ \mu$ . (Tab. 9, fig. 3.) Sample 20.

113. *E. divergens* var. *galpinii* var. nova, affinis *E. divergenti* var. *subbifido* Claassen, sed lobis lateralibus multo brevioribus latioribusque (quam prioris varietatis) et forma lobi polaris differt.

Upper part of lateral lobes shorter and broader than in var. *subbifidum* Claassen, and the shape of the polar lobe is different. Length  $55\ \mu$ ; breadth  $48\ \mu$  (with spines  $53\ \mu$ ); breadth of isthmus  $12\ \mu$ ; maximum breadth of polar lobe  $24\ \mu$ . (Tab. 29, fig. 3.) Sample 68.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

114. *E. dubitabilis* spec. nova, affinis *E. inermi* (Ralfs) Lund., sed discrepantia latitudinis ad basin et ad apicem multo minore bene distincta.

This species is near *E. inermis* (Ralfs) Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 24, Pl. XXXVI, figs. 7, 8); but the apices are not very much narrower than the base of the semicells and the cells are smaller. Cells small, about 2.1-2.2 times longer than broad, deeply constricted, sinus narrowly linear; semicells truncate-pyramidal, basal angles rounded; upper part of lateral margins somewhat concave; apex convex with a narrow median incision. Cell wall smooth. Length  $36.5-38\ \mu$ ; breadth  $16.5-18\ \mu$ ; breadth of isthmus  $7.5-8\ \mu$ ; breadth of apex  $12\ \mu$ . (Tab. 9, fig. 9.) Sample 24.

115. *E. elegans* (Bréb.) Kütz. var. *transvaalense* var. nova, affinis *E. eleganti* var. *madagascariensi* W. et G. S. West, sed forma apicis, incisura apicali multo angustiore, et tumore supra isthmum granulis 4 ornato bene distincta.

This is near *E. elegans* var. *madagascariense* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895-1901, Pl. 6, fig. 18); but differs in the shape of the apex, the apical incision is narrower and the protuberance above the isthmus contains four granules; the cells are slightly smaller than in Messis West's variety. Length  $23-24\ \mu$ ; breadth  $16\ \mu$ ; breadth of isthmus  $3-4\ \mu$ ; breadth of apex  $6.5-8\ \mu$ . (Tab. 9, fig. 18.) Sample 20.



116. *E. galpinii* spec. nova, affinis *E. bidentato* Näg., sed lobo infimo laterali latiore quam lobo laterali supremo et margine apicali recto bene distincta.

Near *E. bidentatum* Näg. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 39, Pl. XXXVII, figs 16–19); but the semicells are broader at the lower lateral lobule than at the upper lateral lobule; apical margin straight. The protuberance in the centre above the isthmus has four granules, and there are a few granules within the lateral lobules and the apex. Length 38  $\mu$ ; breadth 27  $\mu$ ; breadth of isthmus 8  $\mu$ ; breadth of apex 16  $\mu$ . (Tab. 29, fig. 1.) Sample 72.

117. *E. insulare* (Witttr.) Roy. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 68, Pl. XL, figs. 11–13.) Fig. 11 shows a cell during normal cell division and fig. 12 shows an abnormal one. (Tab. 9, figs. 10–12.) Samples 3, 24, 41.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; Galicia in Austria; Norway; Sweden; Siam; United States; Japan; Switzerland; South Africa.

118. *E. obesum* Josh. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 29, Pl. XXXVI, figs. 16, 17.) Sample 52.

*Geographical Distribution*.—England; India; Burma; Singapore; Sumatra; Madagascar; South Africa.

119. *E. pseudovalidum* spec. nova, affinis *E. valido* W. et G. S. West, sed forma cellulae (praecipue ad basin semicellulae) haud multum sed plane differt. Dentes desunt.

Near *E. validum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 75, Pl. XL, figs. 21, 22); but differs in the shape of the basal part of the semicells, and in the absence of teeth. Cells small, about 1.5–1.6 times longer than broad, very deeply constricted, sinus narrowly linear; semicells truncate-pyramidal, lateral margins retuse, inferior angles inflated, superior angles somewhat acutely-rounded; apex broad, truncate-convex, emarginate. Semicells ovate in lateral view, and elliptic in vertical view. Cell wall smooth. Length 36–36.5  $\mu$ ; breadth 22–23  $\mu$ ; breadth of isthmus 8–9.5  $\mu$ ; breadth of apex 14–16  $\mu$ ; thickness 14  $\mu$ . (Tab. 9, figs. 15–17.) Sample 24.

120. *E. rostratum* Ralfs subsp. *unibonatum* W. & G. S. West var. *kranskopense* var. nova, affinis *E. rostrato* subsp. *umbonato* W. et G. S. West, sed sculptura membranae omnino diversa facile distinguenda.

The shape of the cells agrees with that of *E. rostratum* subsp. *umbonato* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 6, fig. 16); but the cell wall sculpture differs. Apex of polar lobe convex, slightly undulate, with a deep and slightly open median notch, a short spine at each outer angle, and a thickening of the cell wall at each angle and below the apical notch. Cell wall punctate, punctae in rows. Length 50–54  $\mu$ ; breadth 30.5–32  $\mu$ ; breadth of isthmus 9–10  $\mu$ ; breadth of apex (without spines) 19–20  $\mu$ . (Tab. 9, figs. 4, 5.) Sample 61.

121. *E. spinulosum* Delponte subsp. *africanum* Nordst. (W. & G. S. West, The Freshwater Algae of Ceylon, Trans. Linn. Soc. London, Ser. 2, Vol. VI, 1901–1902, Pl. 19, fig. 21.) Interlobular incisions slightly deeper than in the typical form. The Doornfontein specimens are considerably larger than the Mosdene specimens.

	Doornfontein	Mosdene
Length.....	78–84 $\mu$	60 $\mu$
breadth.....	68–72 $\mu$	56–60 $\mu$
breadth of isthmus.....	16–18 $\mu$	16 $\mu$

(Tab. 9, fig. 1; Tab. 29, fig. 2.) Samples 20, 68, 72.

*Geographical Distribution*.—Ceylon; South Africa.

122. *E. spinulosum* subsp. *africanum* var. *transvaalense* var. nova, affinis var. *duplo-minori* W. et G. S. West, sed forma lobi polaris et incisuris interlobularibus minus profundis distinguenda.

This differs from var. *duplo-minor* W. & G. S. West (W. & G. S. West, The Fresh-water Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895-1901, Pl. 6, fig. 13) in the shape of the polar lobe, and in having shallower interlobular incisions and larger cells. Lobes more or less semicircular. Length 81-82  $\mu$ ; breadth 62.5-64  $\mu$ ; breadth of isthmus 15-15.5  $\mu$ . (Tab. 9, fig. 2.) Sample 6.

123. *E. schweickerdtii* spec. nova, ab omnibus generis speciebus distincta. Cellulae plus minusve tam longae quam latae. Semicellulae latae et obtuse pyramidales, margine apicali haud penitus inciso, supra isthmum dentes magno munitae; a latere visae planae et ovatae, a vertice ellipticae. Incisura apicali non profunda.

Cells small, about as long as broad, deeply constricted, sinus narrowly linear; semicells broad and flat, apical margin with a shallow median incision; with a tooth in the centre of each semicell above the isthmus. Side view of semicell flattened-ovate and oval in vertical view. Length 27  $\mu$ ; breadth 27-28  $\mu$ ; breadth of isthmus 7  $\mu$ ; thickness 12.5-13  $\mu$  (with teeth 18  $\mu$ ). (Tab. 9, figs. 19-21.) Sample 38.

Named after Prof. Dr. H. G. Schweickerdt, Head of the Department of General Botany, University of Pretoria.

#### *Micrasterias* Ag.

124. *M. americana* (Ehrenb.) Ralfs var. *transvaalensis* var. nova, affinis typo speciei, sed lobo polari bifido et minore differt.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 117, Pl. LIII, figs. 4, 5; Pl. LIV, figs. 1-3) in the shape of the polar lobe. Polar lobe smaller than in the typical form, divided into two equal parts near the base (lateral view of semicell); apical margin with a slight median depression, angles produced into small divergent processes, each with a truncate-denticulate apex. Length 104-108  $\mu$ ; breadth 80-82.5  $\mu$ ; breadth of isthmus 17.5-18  $\mu$ ; maximum breadth of polar lobe 34-35  $\mu$ . (Tab. 16, fig. 4.) Sample 19.

125. *M. apiculata* (Ehrenb.) Menegh. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 97, Pl. XLVII, figs. 1, 2.) Polar lobe less exserted than in the typical form, apical angles with one spine and in some specimens without spines (the typical form has a pair of diverging spines). Some specimens slightly smaller than in the type. Length 210-236  $\mu$  (with spines 238-252  $\mu$ ); breadth 173-196  $\mu$  (with spines 186-217  $\mu$ ); breadth of isthmus 30-35  $\mu$ ; maximum breadth of polar lobe 64-80  $\mu$ . (Tab. 10, figs. 1-4.) Samples 25, 26, 38, 39.

*Geographical Distribution.*—England; France; Germany; Galicia in Austria; Italy; Sweden; Denmark; Bornholm; Finland; Poland; Russia; Japan; India; Burma; United States; First record for South Africa.

126. *M. crux-melitensis* (Ehrenb.) Hass. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 116, Pl. LIII, figs. 1-3.) The shape of the polar and lateral lobes differs slightly from those in the type. Cells slightly larger than in the typical form. Length 116-148  $\mu$  (with processes 128-168  $\mu$ ); breadth 118-126  $\mu$  (with spines 128-140  $\mu$ ); breadth of isthmus 20-23  $\mu$ ; maximum breadth of polar lobe 60-80  $\mu$ . (Tab. 18, figs. 1-14; Tab. 19, figs. 1-11; Tab. 20, figs. 1-6; Tab. 21, figs. 1-4; Tab. 22, figs. 1-6; Tab. 23, fig. 1.) Samples 66, 73, 74.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Galicia; Hungary; Italy; Sweden; Denmark; Poland; North and South Russia; Japan; North India; Ceylon; Burma; Celebes; Madagascar (var.); Central Africa; United States; Brazil; Switzerland; South Africa.

127. *M. crux-melitensis* var. *evoluta* W. B. Turner. (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 6, fig. 1.) Apical margin of the polar lobe with four small teeth; the lateral lobes with more subdivisions than in the typical form. Length 98–124  $\mu$  (with processes 113–144  $\mu$ ); breadth 101–116  $\mu$  (with teeth 111–128  $\mu$ ); breadth of isthmus 17–22  $\mu$ ; maximum breadth of polar lobe 36.5–45  $\mu$ . (Tab. 16, fig. 3; Tab. 17, fig. 1.) Samples 59, 74.

*Geographical Distribution*.—Madagascar; East India; South Africa.

128. *M. crux-melitensis* var. *transvaalensis* var. nova, typo speciei affinis, sed forma lobi polaris distincta et margine apicali paene recto quippe cui pars media leviter sit depressa.

This differs from the typical form in the shape of the polar lobe and in having an almost straight apical margin. Fig. 2 shows a cell shortly after division. Length 98–104  $\mu$  (with processes 110–113  $\mu$ ); breadth 86–98  $\mu$  (with spines 96–105  $\mu$ ); breadth of isthmus 16–19  $\mu$ ; maximum breadth of polar lobe 40–44  $\mu$ . (Tab. 16, figs. 1, 2.) Samples 24, 39.

129. *M. denticulata* Bréb. var. *africana* var. nova, affinis *M. denticulatae* Bréb. var. *angustosinuatae* Gay, sed lobulo polari latiore et brevior, incisuris minus altis bene distinguenda.

This variety is near *M. denticulata* var. *angustosinuata* Gay (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 108, Pl. L, fig. 5); but differs in having a shorter and broader polar lobe and shallower interlobular incisions. Some specimens with slightly exerted polar lobes (fig. 3). Length 234–248  $\mu$ ; breadth 196–220  $\mu$ ; breadth of isthmus 32–40  $\mu$ ; maximum breadth of polar lobe 74–95  $\mu$ . (Tab. 11, figs. 1–4; Tab. 12, fig. 1.) Samples 24, 25, 36, 39.

130. *M. denticulata* var. *subnotata* West forma *cornuta* forma nova, affinis var. *subnotatae* West, sed differt quod in lobis polaribus ad incisuram media utrimque bini sunt processus, quibus singuli denticuli insunt.

This differs from West's variety (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 108, Pl. L, fig. 7) in the polar lobe possessing a pair of processes on each side of the median notch; each process furnished with a small tooth. Cells slightly larger than var. *subnotata* West, and some lobules with more subdivisions. Length 208–256  $\mu$ ; breadth 180–216  $\mu$  (fig. 3, 156  $\mu$ ); breadth of isthmus 26–34  $\mu$ ; maximum breadth of polar lobe 44–52  $\mu$ . (Tab. 12, fig. 2; Tab. 13, figs. 1–3.) Samples 35, 38.

131. *M. decemdentata* (Näg.) Arch. (Nägeli, Gatt. einzell. Algen, 1849, p. 123, Tab. VI, H, fig. 2; F. E. Fritsch & F. Rich, Trans. Roy. Soc. S. Afr., Vol. XI—Part 4, 1924, p. 337, fig. 13.)

Cell wall smooth or punctate. Length 76.5–80  $\mu$ ; breadth 71.5–75.5  $\mu$  (with teeth 79–87  $\mu$ ); breadth of isthmus 15–17  $\mu$ ; maximum breadth of polar lobe 54–60.5  $\mu$ . (Tab. 16, fig. 5–7.) Samples 24, 39.

132. *M. decemdentata* var. *galpinii* var. nova. A typo speciei cellulis multo moniibus distincta. Formae intermediae haud visae.

Cells smaller than in the typical form; lateral angles of polar lobe acuminate. Length 48.5–52  $\mu$ ; breadth 47–51  $\mu$  (with teeth 56–63  $\mu$ ); breadth of isthmus 14–17  $\mu$ ; maximum breadth of polar lobe 40–44  $\mu$ . (Tab. 17, figs. 4–7.) Samples 65, 66, 68, 70, 71, 74.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.



133. *M. groenewaldii* spec. nova, affinis *M. confertae* Lund., sed lobi polaris forma differt et membranae tres processus supra isthmum sunt conspicui.

This species is near *M. conferta* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 88–89, Pl. XLIII, figs. 4–9); but differs in the shape of the polar lobe and each semicell has three processes above the isthmus. Cells fairly large, a little longer than broad, sub-elliptic, deeply constricted, sinus and interlobular incisions open outwards; semicells 5-lobed; polar lobe with convex sides in its lower half, upper half cuneate, apex with a median notch, apical margin with 4–5 spines on each side of the median hollow; superior lateral lobes slightly larger than inferior lateral lobes, each divided into two lobules, lobules again divided, the four ultimate divisions of each lobe being emarginate (or sometimes tridenticulate); the small lobule adjoining the polar lobe usually tridenticulate. Semicells with three projections across the base, the middle one immediately above the isthmus larger than the lateral ones. Cell wall furnished with numerous minute spines, arranged in subradial rows. Cell in vertical view fusiform, poles acute, with three projections on each side towards the middle. Length 184–190  $\mu$  (with spines 197–203  $\mu$ ); breadth 162–166  $\mu$  (with spines 170–174  $\mu$ ); breadth of isthmus 29–33  $\mu$ ; maximum breadth of polar lobe 61–68  $\mu$ . (Tab. 14, figs. 1–4.) Sample 46.

Named after Mr. L. J. Groenewald of Glentig, near Nylstroom.

134. *M. mahabuleshwarensis* Hobson var. *transvaalensis* var. nova, affinis *M. mahabuleshwarensis* var. *tetracero* W. et G. S. West, sed et forma lobi lateralis summi et dispositione dentium distincta. Margo lobi polaris duobus tantum processibus accessoriis est munitus, qui processibus *M. mahabuleshwarensis* similes sed multo breviores sunt.

Near *M. mahabuleshwarensis* var. *tetracerum* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 6, figs. 2–4); but differs in the shape of the upper lateral lobule, and in the arrangement of the small spines; polar lobe with only two accessory denticulate processes like those in var. *wallichii* (Grun.) W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 122, Pl. LIV, figs. 7, 8; Pl. LV, figs. 1–3); but the processes are considerably shorter. Apical margin of polar lobe furnished with four 3-pointed spines; each lobule of the lateral lobes furnished with singular or branched teeth; cell wall with a series of small teeth within the lateral lobes, across the lateral sides of the polar lobe and a few denticulations above the isthmus. Length 128  $\mu$  (with apical processes 148  $\mu$ ); breadth 112  $\mu$ ; breadth of isthmus 28  $\mu$ ; maximum breadth of polar lobe 84  $\mu$ . (Tab. 17, fig. 2.) Samples 65, 71.

135. *M. nylstromica* spec. nova, ex affinitate *M. confertae* Lund., sed et forma lobi polaris et loborum superiorum-lateralium differt et quod dentibus est ornata.

This species somewhat resembles *M. conferta* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 88–89, Pl. XLIII, figs. 4–9); but differs in the shape of the polar and superior lateral lobes; cell wall furnished with small spines. Cells large, broadly elliptic, deeply constricted, sinus narrowly linear; semicells 5-lobed, the interlobular incisions being narrowly linear and not very deep; polar lobe sub-cuneate, lateral angles downwardly curved, apex concave with a median notch, with three spines on each side of the median notch, and a large curved spine on the apical margin close to each angle, and a smaller spine near the extremity; lateral lobes unequal, superior lateral lobes considerably larger than the inferior lateral lobes, each lateral lobe divided into two more or less similar lobules and each lobule furnished with four marginal spines except the lobule adjoining the polar lobe; this lobule consists of a lower part with four marginal spines, and an upper part which consists of a two-spined lower half and a three-spined upper half, the latter with the top spine upwardly curved to overlap the apical angle of the polar lobe. Cell wall strongly punctate and furnished



with numerous minute spines, arranged in subradiate rows within the polar and lateral lobes. Length 264–276  $\mu$  (with spines 278–292  $\mu$ ); breadth 221–226  $\mu$  (with spines 233–241  $\mu$ ); breadth of isthmus 42–43  $\mu$ ; maximum breadth of polar lobe 102.5–108  $\mu$ . (Tab. 12, fig. 3; Tab. 13, fig. 4.) Samples 26, 39.

136. *M. pinnatifida* (Kütz.) Ralfs var. *transvaalensis* var. nova, affinis *M. pinnatifida* var. *divisae* W. West formae *majori* Schmidle, sed differt et forma lobi polaris et quod tuberculi iuxta supra isthmum semicellulae desunt.

This differs from var. *divisa* W. West forma *major* Schmidle (W. Schmidle, Engler Botan. Jahrb., XXXII Bd., 1903, p. 73, Taf. II, fig. 7) in the shape of the polar lobes and in the absence of tubercles above the isthmus in each semicell. Length 108–116  $\mu$ ; breadth 104–116  $\mu$  (with teeth 114–124  $\mu$ ); breadth of isthmus 16–18  $\mu$ ; maximum breadth of polar lobe 74–92  $\mu$ . (Tab. 23, figs. 2, 3.) Samples 72, 74.

137. *M. sol* (Ehrenb.) Kütz. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 95, Pl. XLVI, figs. 1, 2.) These specimens are slightly smaller than in the typical form. Length 146–152  $\mu$ ; breadth 146–152  $\mu$ ; breadth of isthmus 18–20  $\mu$ ; maximum breadth of polar lobe 32–36  $\mu$ . (Tab. 15, fig. 6.) Samples 24, 25, 39.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Italy; Sweden; Denmark; United States; Jamaica; Brazil; First record for South Africa.

138. *M. tropica* Nordstedt var. *elongatissima* var. nova, affinis *M. tropicae* var. *elongatae* Schmidle, sed forma lobi polaris et dispositione dentium valde distincta. Cellula non duplo longior quam latior.

Near var. *elongata* Schmidle (W. Schmidle, Engler Botan. Jahrb., Vol. 26, 1899, p. 48, Taf. III, fig. 13); but the proportion of length to breadth is not 2:1, and the shape of the polar lobe and the arrangement of the spines differ. Cells longer than in var. *elongata* Schmidle, polar lobes shorter and with a distinct constriction below the apex, apical margin concave, with the angles produced into short processes. Cell wall furnished with seven series of small spines within the lateral lobes, and with a number of spines within the lateral margins of the polar lobe. Length 112–128  $\mu$ ; breadth 76–80  $\mu$ ; breadth of isthmus 16  $\mu$ ; maximum breadth of polar lobe 22–24  $\mu$ . (Tab. 17, fig. 3.) Sample 73.

139. *M. truncata* (Corda) Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 82, Pl. XLII, figs. 1–8; Pl. XLV, figs. 5, 6.) These specimens are usually slightly shorter than broad. Length 124–132  $\mu$ ; breadth 124–138  $\mu$ ; breadth of isthmus 22.5–27  $\mu$ ; maximum breadth of polar lobe 82–100  $\mu$  (without spines 76–94  $\mu$ ). (Tab. 15, figs. 1–3.) Samples 24, 25, 39.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Galicia; Hungary; Italy; Norway; Sweden; Denmark; Bornholm; Finland; Poland (form); North and South Russia; Faeroes; North India; Sandwich Islands; United States; Brazil; Switzerland; Japan; South Africa.

140. *M. truncata* var. *africana* Fritsch & Rich. (F. E. Fritsch & F. Rich, Trans. Roy. Soc. S. Afr., Vol. XI—Part 4, 1924, p. 338, fig. 14B and C.) Polar lobe somewhat variable in shape, cuneate or with subparallel sides in the lower portion and dilated in the upper portion. Length 134–152  $\mu$ ; breadth 124–136  $\mu$  (without spines 120–131  $\mu$ ); breadth of isthmus 25.5–26  $\mu$ ; maximum breadth of polar lobe 62–67  $\mu$ . (Tab. 15, figs. 4, 5.) Samples 24, 39.

*Geographical Distribution.*—South Africa.

141. *M. truncata* var. *minor* var. nova. Cellulae varietatis quam typi speciei aliquanto minores sunt. Formae intermediae haud visae.

These specimens are considerably smaller than in the type. Lateral angles of polar lobe acuminate; cell wall punctate. Length  $57.5-60\ \mu$ ; breadth  $56-60\ \mu$  (with spines  $62-66\ \mu$ ); breadth of isthmus  $12.5-13\ \mu$ ; maximum breadth of polar lobe  $44-50\ \mu$ . (Tab. 17, fig. 8.) Sample 74.

#### *Cosmarium Corda*

142. *C. barbaricum* spec. nova, affinis *C. entochondro* W. et G. S. West, sed membrana cellulae glabra, sinu undulato et marginibus lateralibus magis undulatis facile distinguenda.

Near *C. entochondrum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 193, Pl. LXXXVII, fig. 17); but the sides have more undulations, the sinus is undulate and the cell wall is smooth. Cells small, about as long as broad, deeply constricted, sinus narrow and slightly crenate; semicells semicircular, apex truncate, basal angles furnished with a spine, sides convex and with 3-5 undulations, apical margin smooth. Chloroplasts axile, each with two pyrenoids. Length  $20-28\ \mu$ ; breadth  $19-28\ \mu$ ; breadth of isthmus  $9.5-10\ \mu$ ; breadth of apex  $10-14\ \mu$ . (Tab. 26, fig. 16.) Sample 24.

143. *C. binum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 246, Pl. LXXXVIII, figs. 10-14.) Some specimens with two horizontal series of granules below the conspicuous tumour immediately adjacent to the isthmus. (Tab. 27, figs. 1, 2.) Samples 7, 8, 12, 19, 20, 21, 23, 30, 35, 42, 43, 46, 47, 48, 51, 52, 53, 54, 57, 58, 65, 66, 72.

*Geographical Distribution*.—Scotland; Austria; Poland; Ceylon; Sumatra; Central Africa; Brazil; Australia; United States; South Africa.

144. *C. botesii* spec. nova, affinis *C. praemorso* Bréb., sed et dispositione granulorum omnino dissimili et membrana cellulae leviter undulata differt.

This species differs from *C. praemorsum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 196, Pl. LXXXIV, figs. 1-5) in the cell wall sculpture and in having slightly undulate margins. Cells of medium size, about 1.1-1.3 times as long as broad, deeply constricted, sinus narrowly linear; semicells semicircular, apex truncate, sides with 3-6 distinct and a number of obscure undulations, apical margin smooth or with about 3-4 undulations. Cell wall minutely punctate and with a number of large scattered granules in the upper part of the semicell. Each chloroplast contains two pyrenoids. Length  $46-49\ \mu$ ; breadth  $39-41\ \mu$ ; breadth of isthmus  $11-12.5\ \mu$ . (Tab. 27, figs. 3, 4.) Samples 24, 25.

Named after Mr. P. W. Botes of Moddernek, Nylstroom.

145. *C. caffrorum* spec. nova, affinis *C. subundulato* Wille, sed semicellulis paulo applanatis, membranis lateralibus solum undulatis, ore sinus denticulato, distinguitur.

This comes near *C. subundulatum* Wille (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 151, Pl. LIX, figs. 13-15); but the semicells are slightly flattened, only the lateral margins are undulate and there is a small spine at each basal angle. Cells small, 1.2-1.3 times longer than broad, deeply constricted, sinus narrow, linear or slightly undulate; semicells truncate-pyramidal, basal angles furnished with a spine, sides convex with 3-4 undulations. Cell wall slightly thickened at the apex; chloroplasts axile, with two pyrenoids each. Length  $33-42.5\ \mu$ ; breadth  $26-33\ \mu$ ; breadth of isthmus  $8.5-10.5\ \mu$ . (Tab. 25, figs. 7, 8.) Sample 24.

146. *C. connatum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 25, Pl. LXVII, figs. 15–17.) Sample 71.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria; Hungary; Galicia; Italy; Norway; Sweden; Denmark; Bornholm; Finland; South Russia; Japan; India; Burma; Singapore; Sumatra (form); Java; Central Africa; Sandwich Isles; United States; Guiana; Brazil; Switzerland; South Africa.

147. *C. connatum* var. *subellipticum* var. nova, affinis *C. connato* var. *truncato* West, sed semicellulis plus deplanatis et sinu aliquanto profundiore differt.

This is closely allied to *C. connatum* var. *truncatum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 26, Pl. LXVII, fig. 18); but differs in the character of the sinus and in having more flattened semicells. Cells of medium size, about 1·3–1·4 times as long as broad, deeply constricted, sinus widely open; semicells subelliptic with a flattened apex. Cell wall smooth and colourless and thickened at the apices. Chloroplasts with two pyrenoids each. Length 48–49·5  $\mu$ ; breadth 37–40  $\mu$ ; breadth of isthmus 14–17  $\mu$ ; breadth of apex 14–17  $\mu$ . (Tab. 27, fig. 8.) Sample 24.

148. *C. contractum* Kirchn. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 170, Pl. LXI, figs. 23–25, 34.) Sample 24.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; Germany; Galicia in Austria; Poland; Norway; India; Ceylon; Burma; Siam; Australia; Central Africa; Madagascar; United States; Patagonia; First record for South Africa.

149. *C. contractum* forma *jacobsenii* (Roy) W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 171, Pl. LXI, fig. 26.) Sample 71.

*Geographical Distribution.*—England; Scotland; Germany; Galicia in Austria; Norway; Sweden; Denmark; Bornholm; Central Africa; South Africa.

150. *C. contractum* var. *ellipsoideum* (Elv.) West. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 172, Pl. LXI, figs. 28, 35.) Sample 38.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; Germany; Sweden; Finland; North Russia; Faeroes; Iceland; Australia; Switzerland; South Africa.

151. *C. contractum* var. *pseudogartanense* var. nova. Cellulae plus orbiculatae quam in typo, membrana marginis apicalis incrassata.

The semicells are more rounded than in the typical form; cell wall thickened at the apices and punctate. This is near var. *gartanense* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 173, Pl. LXI, fig. 27) in shape; but the apex is not retuse-emarginate. Length 47–48  $\mu$ ; breadth 30–31  $\mu$ ; breadth of isthmus 14  $\mu$ . (Tab. 24, fig. 6.) Sample 39.

152. *C. debaryi* Arch. var. *minor* var. nova. Differt a typo speciei cellulis dimidio minoribus et in medio margine apicali incisura minime profunda. Formae intermediae haud visae.

These specimens are about half the size of the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 61, Pl. LXX, figs. 14–16; Pl. XCIII, fig. 2); apical margin with a shallow median incision. Length 46·5–48  $\mu$ ; breadth 22·5–23  $\mu$ ; breadth of isthmus 17  $\mu$ ; thickness 18–20  $\mu$ . (Tab. 25, figs. 15, 16.) Sample 39.



153. *C. decoratum* W. & G. S. West. (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 7, fig. 21.) Cell wall sculpture only distinct in the median parts of the front, vertical and side views of the semicell as the semicell is not flat but ovate in side view and elliptic in vertical view. In this respect I do not agree with Messrs. West's figures. Samples 30, 46.

*Geographical Distribution*.—Madagascar; First record for South Africa.

154. *C. decoratum* var. *galpinii* var. nova, a typo speciei cellulis latioribus et membranae sculptura in media tantum parte conspicua differt.

Cells broader than in the type; cell wall sculpture only distinct in the median part of the semicell; cells about 1.2 times longer than broad. Length  $84\ \mu$ ; breadth  $70\ \mu$ ; breadth of isthmus  $24\ \mu$ . (Tab. 29, fig. 11.) Sample 72.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

155. *C. decoratum* var. *waterbergense* var. nova, a typo speciei hiatibus, quibus sculptura membranae consistit, plus confertis—qui ornatus non per totam superficiem membranae apparet—et magnis granulis in ordinem circum marginem cellulae dispositis bene distincta.

Cell wall sculpture only distinct in the median part of the semicells and with a series of fairly large granules situated on the margins; cells about 1.4 times longer than broad. Length  $73\text{--}82\ \mu$ ; breadth  $52\text{--}60.5\ \mu$ ; breadth of isthmus  $20\text{--}23.5\ \mu$ . (Tab. 24, fig. 11.) Sample 54.

156. *C. galpinii* spec. nova, affinis *C. isthmochondro* Nordst., sed differt quod margo apicalis duorum ordinum—quorum alter tantum a fronte videri potest—granulis quaternis magnis est ornatus; porro membranae sculptura toto caelo differt.

This species is near *C. isthmochondrum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 173, Pl. LXXXI, fig. 7); but differs in that the apical margin contains two series of four large granules each (only one series visible in front view of semicell), and in the cell wall sculpture. Cells small, about 1.2 times as long as broad, fairly deeply constricted, sinus narrowly linear; semicells truncate-semicircular, apical margin straight, with a series of four large granules; cell wall colourless or yellowish-brown, punctate, and with a number of scattered granules. Vertical view more or less elliptic, with two circular series of granules in the centre, two series of four granules each on each side, and three smaller granules arranged in a triangle within the poles. Length  $36\ \mu$ ; breadth  $29\ \mu$ ; breadth of isthmus  $14\ \mu$ ; thickness  $24\ \mu$ . (Tab. 29, figs. 5, 6.) Samples 65, 70.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

157. *C. granatum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 186, Pl. LXIII, figs. 1–4.) Sample 43.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Poland; Hungary; Italy; Bosnia; Portugal; Norway; Sweden; Denmark; Bornholm; Finland; North and South Russia; Siberia; Faeroes; Iceland; Greenland; Spitzbergen; Nova Zembla; Afghanistan; Kordofan; India; Ceylon; Burma; Central China; New Zealand; Australia; West, Central and East Africa; Madagascar; United States; West Indies; Ecuador (var.); Brazil; Paraguay (var.); Argentina; Patagonia; Switzerland; South Africa.

158. *C. granatum* var. *africanum* Fritsch. (F. E. Fritsch & E. Stephens, Trans. Roy. Soc. of S. Afr., Vol. IX, 1921, p. 32, fig. 11C.) (Tab. 25, figs. 17, 18; Tab. 29, fig. 4.) Samples 39, 74.

*Geographical Distribution*.—South Africa; Switzerland.



159. *C. hammeri* Reinsch. var. *minor* var. nova, a typo speciei cellulis dimidio minoribus differt. Formae intermediae haud visae.

Cells less than half the size of the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 181, Pl. LXXII, figs. 20, 21); and about 1.3–1.6 times longer than broad. Length 16–19  $\mu$ ; breadth 12  $\mu$ ; breadth of isthmus 3–4  $\mu$ . (Tab. 24, fig. 13.) Sample 24.

160. *C. impressulum* Elfv. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 86, Pl. LXXII, figs. 14–18.) Some specimens are considerably smaller than in the typical form, viz.: length 16–21  $\mu$ ; breadth 12–15  $\mu$ ; breadth of isthmus 3–4  $\mu$ . (Tab. 24, figs. 14, 15.) Samples 7, 19, 42.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Switzerland; Bohemia and Galicia in Austria; Denmark; Finland; Faeroes; Greenland; Bosnia; Siberia; Japan; India; New Zealand; Australia; West and East Africa; Azores; United States; Brazil; Argentina; Patagonia; South Africa.

161. *C. laeve* Rabenh. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 99, Pl. LXXIII, figs. 8–19.) Samples 37, 38.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Galicia in Austria; Hungary; Italy; Spain; Portugal; Norway; Poland; North Russia; Faeroes; Nova Zembla; India; Ceylon; Burma; Siam; Australia; Madagascar; Central and East Africa; Azores; United States; West Indies; Ecuador; Uruguay; Argentina; Patagonia; Switzerland; South Africa.

162. *C. laeve* var. *majus* var. nova. Differt a typo speciei cellulis multo maioribus. Formae intermediae haud visae.

This differs from the typical form in having much larger dimensions. Cells 1.5–1.7 times longer than broad. Length 48–50  $\mu$ ; breadth 29–32  $\mu$ ; breadth of isthmus 10–11  $\mu$ . (Tab. 24, fig. 7.) Samples 37, 39.

163. *C. maximum* (Börg.) W. & G. S. West var. *minor* West. (W. & G. S. West, Welwitsch's African Freshwater Algae, Journ. of Bot., Vol. XXXV, 1897, p. 114, Tab. 367, fig. 21.) Cells slightly larger than in the typical form. Length 69.5–70  $\mu$ ; breadth 55.5–58  $\mu$  (with spines 60.5–66  $\mu$ ); breadth of isthmus 12–14.5  $\mu$ . (Tab. 27, fig. 5.) Sample 24.

*Geographical Distribution*.—Central Africa; First record for South Africa.

164. *C. meneghinii* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 90, Pl. LXXII, figs. 29–32.) Sample 38.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria (and Galicia); Hungary; Italy; Norway; Sweden; Denmark; Bornholm; Finland; Poland; Lapland; North, Central and South Russia; Faeroes; Iceland; Nova Zembla; Greenland; Siberia; Mongolia; China; Japan; India; Ceylon; Siam; Chatham Island; New Zealand; Madagascar; Central Africa; Azores; United States; Porto Rico; Jamaica; Brazil; Ecuador; Paraguay; Argentina; Patagonia; Switzerland; South Africa.

165. *C. nanum* spec. nova, affinis *C. pseudarcto* Nordst., sed cellulis ad apicem leviter deplanatis et sinu profunde constricto distincta.

Near *C. pseudarctum* Nordst. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 32, Pl. LXVIII, figs. 12–14; Pl. LXXII, figs. 40, 41); but the cells are slightly depressed at the apices and are deeply constricted at the sinus. Cells very small, 1.7–1.8 times as long as broad; sinus narrowly linear; semicells semicircular with a slightly

truncately-rounded apex. Cell wall smooth. Each chloroplast contains one central pyrenoid. Length 14–20  $\mu$ ; breadth 8–12  $\mu$ ; breadth of isthmus 3–4.5  $\mu$ . (Tab. 24, fig. 12.) Sample 19.

166. *C. norimbergense* Reinsch. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 52, Pl. LXIX, figs. 25–27.) Sample 38.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; Germany; Hungary; Sweden; Bornholm; Finland; India; Ceylon; Siam; New Zealand; Central Africa; Japan; First record for South Africa.

167. *C. nylstromicum* spec. nova., affinis *C. năgeliano* Bréb., sed cellulis multo maioribus, numero undulationum membranae et forma angulorum basalium semicellularum differt.

This somewhat resembles *C. năgelianum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 14, Pl. LXVI, fig. 12); but differs in the number of undulations, the delineation of the basal angles of the semicells, and in having larger dimensions. Cells of medium size, about 1.2–1.3 times longer than broad, deeply constricted, sinus narrowly linear with a slightly dilated extremity; semicells truncate-pyramideate, basal angles rounded, sides with 4–5 undulations, apical margin with four undulations; cell wall smooth and colourless. In each semicell there is one axile chloroplast containing a single central pyrenoid. Length 41–49  $\mu$ ; breadth 33–36  $\mu$ ; breadth of isthmus 18–19.5  $\mu$ ; breadth of apex 18–20  $\mu$ . (Tab. 26, fig. 13.) Sample 19.

168. *C. obliquum* Nordst. forma *minima* West. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 51, Pl. LXIX, figs. 22, 23.) Sample 27.

*Geographical Distribution*.—England; Norway; First record for South Africa.

169. *C. obsoletum* (Hantzsch) Reinsch var. *transvaalense* var. nova. Hae cellulae praeter membranae crassationem ad semicellularem basium angulos, etiam alteram membranae crassationem ad apicem ostendunt, polis plus quam in typo applanatis.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 133, Pl. LVI, figs. 1–3) in the cell wall being thickened at the apices; semicells more depressed. Length 40–46  $\mu$ ; breadth 46–50  $\mu$ ; breadth of isthmus 12–13  $\mu$ . (Tab. 28, figs. 1–3.) Samples 24, 25, 27, 38, 39, 41.

170. *C. orthostichum* Lund. var. *compactum* W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 169, Pl. LXXX, fig. 22.) Samples 7, 43.

*Geographical Distribution*.—Scotland; First record for South Africa.

171. *C. orthostichum* var. *pseudopumilum* var. nova, affinis var. *pumilo* Lund., sed semicellulis minus applanatis et sculptura membranae toto caelo differt.

This differs from var. *pumilum* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 169, Pl. LXXX, figs. 20, 21) in having less flattened semicells and in the sculpture of the cell wall. Cells small, a little longer than broad, deeply constricted, sinus open outwards; semicells subelliptic, with a somewhat flattened apex. Cell wall granulate, granules without any definite arrangement; chloroplasts with one pyrenoid each. Length 23–29  $\mu$ ; breadth 19.5–24  $\mu$ ; breadth of isthmus 8.5–12  $\mu$ . (Tab. 25, fig. 3.) Sample 3.

172. *C. orthostichum* var. *transvaalense* var. nova, a typo speciei numero et dispositione granulorum in membrana et sinu angustiore differt.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 167, Pl. LXXX, figs. 12–19) in the number and disposition of the granules, and in having a narrower sinus. Cell wall granulate, granules arranged in 9–10 vertical

series, with 4–6 granules in each series; granules more or less of the same size. Length 19–22  $\mu$ ; breadth 16–18  $\mu$ ; breadth of isthmus 5.5–6  $\mu$ . (Tab. 26, fig. 8.) Samples 20, 22.

173. *C. pachydermum* Lund. var. *waterbergense* var. nova, affinis *C. pachydermo* var. *aethiopicum* W. et. G. S. West, sed cellulis aliquanto minoribus et ad apicem deplanatis differt.

This is near *C. pachydermum* var. *aethiopicum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 140, Pl. LVII, figs. 8, 9); but differs in having smaller dimensions and flattened apices and in the cell wall sculpture. Cell wall more or less regularly granulate, granules small. Length 43–54  $\mu$ ; breadth 36–46  $\mu$ ; breadth of isthmus 21–25  $\mu$ . (Tab. 28, fig. 4.) Samples 18, 51, 52, 53, 54, 57, 58, 72.

174. *C. pseudamoenum* Wille. (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 31, Pl. CII, figs. 7–9.) (Tab. 29, figs. 9, 10.) Samples 66, 70, 71.

*Geographical Distribution.*—England; Ireland; Germany; Galicia in Austria; Sweden; Bornholm; Finland; North Russia; Central China; New Zealand; East Africa; United States; Brazil; First record for South Africa.

175. *C. pseudoprotractum* spec. nova, affinis *C. protracto* (Näg.) De Bary, sed lobo polari amplius rotundato, forma cellulae a latere visae et dispositione granulorum differt.

Near *C. protractum* (Näg.) De Bary (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 181, Pl. LXXXII, fig. 8; Pl. XCLV, figs. 4, 5); but the shape of the apical lobe, the shape of the semicells in lateral view and the arrangement of the granules differ. Cells of medium size, longer than broad, deeply constricted, sinus narrowly linear with a slightly dilated extremity; semicells 3-lobed, with a subrectangular incision between the apical lobe and each lateral lobe, lateral and apical lobes broadly rounded and fairly short; lobes granulate, granules large and arranged in 3–4 more or less distinct horizontal rows and in somewhat irregular vertical rows. Side view of semicell subovate; vertical view rather narrowly elliptic, with a smooth protuberance at the middle on each side. Chloroplasts axile, with one pyrenoid each. Length 48  $\mu$ ; breadth 32–34  $\mu$ ; breadth of isthmus 12.5–14  $\mu$ ; thickness 20–21  $\mu$ ; breadth of apical lobe 16–19  $\mu$ . (Tab. 25, figs. 4–6.) Samples 9, 11.

176. *C. pseudopyramidatum* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 201, Pl. LXIV, figs. 9–12.) Samples 19, 25.

*Geographical Distribution.*—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Poland; Hungary; Italy; Norway; Sweden; Finland; North and South Russia; Siberia; Spitzbergen; Nova Zembla; Faeroes; Ceylon; Siam; New Zealand (var.); Australia; West, Central and East Africa; Madagascar; United States; West Indies; Brazil; Paraguay; Uruguay; Switzerland; Mozambique; South Africa.

177. *C. pseudotaxichondrum* Nordst. var. *atomicum* var. nova, affinis *C. pseudotaxichondro* var. *siamensi* W. et G. S. West, sed membrana haud undulata, cellula a vertice visa ad polum utrimque denticulo ornata distincta est.

This variety is near var. *siamense* W. & G. S. West (W. & G. S. West, Siamese Desmids, Botanisk Tidsskrift, Bind 24, 1902, p. 173, Tavle 3, fig. 26); but there are no undulations; each pole has a small tooth in vertical view. Length 31–32  $\mu$ ; breadth 28–28.5  $\mu$ ; breadth of isthmus 11–12  $\mu$ ; thickness 16–18  $\mu$ . (Tab. 25, figs. 1, 2.) Sample 3.



178. *C. pyramidatum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 199, Pl. LXIV, figs. 5-7.) Samples 24, 25, 27, 39.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Italy; Norway; Sweden; Denmark; Bornholm; Finland; South Russia; India; Ceylon; Burma (form); West Africa; Azores; United States; Brazil; Paraguay; Uruguay (form); Argentina; Patagonia (form); Switzerland; Japan; Mozambique; South Africa.

179. *C. pyramidatum* var. *elongatum* var. nova. Differt a typo speciei cellulis dimidio longioribus, nulla latitudinis discrepantia.

The cells are about one and a half times longer than the typical form; but the difference in breadth is slight. Cells very large, slightly more than twice as long as broad; sides of semicells almost straight, apex slightly concave, cell wall with a thickening at the apices and densely punctate. Length 149-150  $\mu$ ; breadth 69.5-70  $\mu$ ; breadth of isthmus 26-28  $\mu$ . (Tab. 27, fig. 10.) Sample 22.

180. *C. pyramidatum* var. *majus* var. nova, a typo speciei et cellulis aliquantulo maioribus et quod membranae cellularum in apicibus crassiores fiunt, et semicellularis non ita constanter truncatis et pyramidalibus differt.

The shape of the cells in front view is somewhat variable, the cells are larger than in the typical form, and the cell wall is densely punctate and thickened at the apices. This may also be compared with *C. pseudopyramidatum* Lund. subsp. *maximum* Börgesen forma *minor* Fritsch & Rich (F. E. Fritsch & F. Rich, Trans. Roy. Soc. of S. Afr., Vol. XI—Part 4, 1924, p. 347, fig. 17-E-G) to which it has a great resemblance as far as the shape of its semicells in front view is concerned, but from which it differs in having larger dimensions, in having no thickening of the membrane in the region above the isthmus, as seen in lateral and vertical views in the majority of the specimens investigated, and in the individuals always containing two pyrenoids per semicell. Length 118-130  $\mu$ ; breadth 70-76  $\mu$ ; breadth of isthmus 26-30  $\mu$ . (Tab. 24, figs. 4, 5.) Samples 38, 39, 41.

181. *C. quadratum* Ralfs var. *africanum* Fritsch. (F. E. Fritsch & E. Stephens, Trans. Roy. Soc. of S. Afr., Vol. IX, 1921, p. 33, fig. 12.)

Cells about 1.6-1.8 times as long as broad; basal angles of semicells less prominent than in the type; cell wall distinctly punctate. Length 41-64  $\mu$ ; breadth 24-36  $\mu$ ; breadth of isthmus 8-10  $\mu$ . (Tab. 24, fig. 10.) Sample 24.

*Geographical Distribution*.—South Africa.

182. *C. reniforme* (Ralfs) Arch. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 157, Pl. LXXIX, figs. 1, 2; Pl. LXXXII, fig. 15.) Specimens usually slightly smaller than in the typical form. Length 40-46  $\mu$ ; breadth 38-48  $\mu$ ; breadth of isthmus 13-17  $\mu$ . (Tab. 28, figs. 5, 6.) Samples 4, 7, 19, 30, 32, 42, 47, 48, 51, 57.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Switzerland; Austria and Galicia; Italy; Norway; Sweden; Faeroes; Greenland; Spitzbergen; United States; Brazil; Argentina; South Africa.

183. *C. schweickerdii* spec. nova, affinis *C. cucumi* (Corda) Ralfs. Margo apicalis membranae crenis—binis vel ternis—ornatus est; iuxta marginem apicalem bina vel terna granula adsunt conspicua ac sub granulis 3 vel 4 depressiones ellipticae.

Near *C. cucumis* (Corda) Ralfs (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 152, Pl. LIX, figs. 18-20); but the apical margin has 2-3 crenations, there are 2-3 large granules within the median part of the apex and 3-4 elliptical depressions just below the granules. Cells small, about 1.4 times longer than broad, deeply con-



stricted, sinus narrowly linear; semicells more or less semicircular. Cell wall punctate. Length 38–40  $\mu$ ; breadth 28  $\mu$ ; breadth of isthmus 10–11  $\mu$ . (Tab. 29, figs. 7, 8.) Sample 71.

Named after Prof. Dr. H. G. Schweickerdt, Head of the Department of General Botany, University of Pretoria.

184. *C. sexangulare* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 81, Pl. LXXII, fig. 3.) (Tab. 25, fig. 9.) Samples 24, 25.

*Geographical Distribution*.—Scotland; Germany; Galicia in Austria; Hungary; Sweden; Poland; North and South Russia; Japan; Australia; East Africa; Azores; United States; South Africa.

185. *C. sexnotatum* Gutw. var. *simplex* var. nova, affinis *C. sexnotato* var. *tristriato* (Lütkem.) Schmidle, sed membrana cellulae omnino glabra differt.

Near var. *tristriatum* (Lütkem.) Schmidle (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 228, Pl. LXXXVI, figs. 8, 9); but the cell wall is smooth and without granules. Sides of semicells convex and 5-crenate, apex truncate and straight. Length 28  $\mu$ ; breadth 22  $\mu$ ; breadth of isthmus 10  $\mu$ ; breadth of apex 11–12  $\mu$ . (Tab. 24, figs. 8, 9.) Sample 19.

186. *C. speciosum* Lund. var. *simplex* Nordst. forma *africanum* forma nova, a varietate *simplici* Nordst. forma genuinum numero granulorum et cellula apicem versus minus deplanata differt.

These specimens form a group within the limits of Nordstedt's variety (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 250, Pl. LXXXIX, fig. 6); but which nevertheless can be distinguished by the number of granules and less attenuated apices. Margins of semicells crenate, crenations 14–16 (four apical and 5–6 lateral); granulate within the margins, granules in regular radial series, seven granules in each series, basal vertical series of granules absent. Chloroplasts axile, with one pyrenoid each. Length 44–48  $\mu$ ; breadth 26–28  $\mu$ ; breadth of isthmus 16–18  $\mu$ . (Tab. 26, figs. 9, 10.) Sample 19.

187. *C. subauriculatum* W. & G. S. West. (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 6, fig. 31.) Sample 71.

*Geographical Distribution*.—Madagascar; South Africa.

188. *C. subconnatum* spec. nova, a latere visa affinis *C. connato* Bréb. var. *truncato* West, sed a fronte visa cellulis plus deplanatis et pyramidalibus distincta.

In lateral view, this species resembles the front view of *C. connatum* Bréb. var. *truncatum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1908, p. 26, Pl. LXVII, fig. 18); but it has rounded apices; the semicells in front view are somewhat truncate-pyramidal. Cells of medium size, about 1·1–1·3 times longer than broad, moderately constricted, sinus very widely open with an obtuse apex; semicells transversely subelliptic with a broad base, apex flattened. Cell wall punctate with two series of minute punctae on each side of the isthmus. Side view of semicell subovate. Chloroplasts containing two pyrenoids each. Length 42–66  $\mu$ ; breadth 34–56  $\mu$ ; breadth of isthmus 24–38  $\mu$ . (Tab. 26, figs. 14, 15.) Sample 20.

189. *C. subcostatum* Nordst. var. *warmbadianum* var. nova, differt a typo speciei dispositione et numero granulorum in membrana.

This differs from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 236, Pl. LXXXVII, figs. 3–5) in the number and arrangement of the granules. Sides of semicells convex and crenulate, with about two small entire crenulations near the basal angles and 3–5 emarginate (or bigranulate) crenulations on the rest of the

lateral margin; apex truncate and with a few small undulations; within the margin minutely granulate, granules radially and concentrically disposed; opposite each of the three crenulations at the base of the semicell is a series of three granules, the two series next to the margin opposite the next crenulation binate and the series nearest the centre single, the first series next to the margin opposite the following two crenulations binate and the second and third series single; next to the apex two series of two granules each; in the centre, above the isthmus with a granulated tumour, granules in three vertical series of three each. Length 32–36  $\mu$ ; breadth 27–30  $\mu$ ; breadth of isthmus 10–12  $\mu$ ; breadth of apex 12–13  $\mu$ . (Tab. 25, figs. 12–14.) Sample 48.

190. *C. subtumidum* Nordst. var. *klebsii* (Gutw.) W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 193, Pl. LXIII, figs. 21–23.) Sample 7.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; Germany; Galicia in Austria; South Africa.

191. *C. subtumidum* var. *theronii* var. nova, affinis *C. subtumidum* var. *klebsii* (Gutw.) W. et G. S. West, sed cellulis triplo maioribus, membrana cellulae densis punctis distincta, sinu foras aperto differt.

Near var. *klebsii* (Gutw.) W. & G. S. West; but differs in the cells being about thrice the size of var. *klebsii*, and in having an open sinus and a densely punctated cell wall. Cells very large, about 1.2–1.4 times as long as broad, deeply constricted, sinus open; semicells broadly pyramidal with truncate apices, basal angles rounded. Cell wall very densely punctate, with a thickening at the apex of each semicell. Each chloroplast with two pyrenoids. Length 141.5–148  $\mu$ ; breadth 104–124  $\mu$ ; breadth of isthmus 42–44  $\mu$ ; breadth of apices 40–43.5  $\mu$ . (Tab. 27, fig. 9.) Samples 42, 72.

Named after Mr. J. E. Theron of Rietfontein 288, near Nylstroom.

192. *C. tetragonum* (Näg.) Arch. var. *transvaalense* var. nova, affinis *C. tetragonum* var. *eleganti* (Roy et Biss.) W. et G. S. West, sed numero undulationum membranae, sculptura eiusdem, et cellula apicem versus minus vel omnino non deplanata differt.

Near var. *elegans* (Roy et Biss.) W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 20, Pl. LXVI, fig. 27); but differs in the number of undulations. In the cell wall sculpture and in the semicells, which are less attenuated towards the apices. Cells about 1.6–1.7 times as long as broad; sides of semicells (including the angles) 7–8-undulate, apex with 8–10 undulations; with a series of three granules within each lateral undulation and a series of five granules within each apical undulation. In each semicell there is one axile chloroplast containing two pyrenoids. Length 44–51  $\mu$ ; breadth 29–34  $\mu$ ; breadth of isthmus 17–20.5  $\mu$ ; breadth of apices 21–32  $\mu$ . (Tab. 26, figs. 11, 12.) Sample 19.

193. *C. trachypleurum* Lund. var. *pseudonatalensis* var. nova, affinis *C. trachypleurum* var. *natalensis* Fritsch et Rich, sed hic spinarum vel maxima pars in margine sita, quum in Fritschii et Richii varietate aliquantulum introrsum ab margine absit.

This differs from var. *natalensis* Fritsch & Rich (F. E. Fritsch & F. Rich, Trans. Roy. Soc. of S. Afr., Vol. XI—Part 4, 1924, p. 349, fig. 18–I–J) in having pronounced spines on the margins and about three series of spines within the margins. Length 60–64  $\mu$  (with spines 67–69  $\mu$ ); breadth 48–51.5  $\mu$  (with spines 56–57  $\mu$ ); breadth of isthmus 18–19  $\mu$ . (Tab. 27, fig. 7.) Sample 24.

194. *C. trachypleurum* var. *pseudonatalensis* forma *irregulare* forma nova. Dentes temere dispositi. Semicellula dentibus ternis sub margine apicali glabro munita est.

In these specimens the spines are irregularly disposed, and there are three spines just within the apical margin, which is smooth. Length 58–59  $\mu$ ; breadth 44–47  $\mu$ ; breadth of isthmus 16–17  $\mu$ . (Tab. 27, fig. 6.) Sample 25.

195. *C. trachypleurum* var. *subspinosum* var. nova, affinis *C. trachypleuro* var. *spinoso* West, sed differt quod singularum semicellularum media in parte iuxta supra isthmum quattuor tantum spinulae adsunt.

The specimens closely resemble var. *spinosum* West (G. Nygaard, Trans. Roy. Soc. of S. Afr., Vol. XX—Part 2, 1932, p. 142, fig. 43; W. & G. S. West, Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2—Bot., Vol. V, 1895–1901, Pl. 7, fig. 17) except that the median tumour contains only four granules. The shape of the semicells in front view has a greater resemblance to the figure by Nygaard than to the type illustrated by Messrs. West. Length 42–42.5  $\mu$ ; breadth 32.5–34  $\mu$ ; breadth of isthmus 12–13  $\mu$ ; breadth of apices 16–18  $\mu$ . (Tab. 25, fig. 10.) Sample 47.

196. *C. transvaalense* spec. nova, affinis *C. trachypleuro* Lund., sed semicellulis minus applanatis, margine apicali spinis munito, ore sinus spinoso, et omni spinarum dispositione valde distincta.

This species is near *C. trachypleurum* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 172, Pl. LXXXI, figs. 2, 3); but the semicells are less flattened, there are spines on the apical margin, there is a spine at each basal angle, and the cell wall sculpture is different. Cells of medium size, about 1.1–1.3 times longer than broad, deeply constricted, sinus narrowly linear; semicells semicircular, apex somewhat flattened. Cell wall punctate and furnished with a number of irregularly disposed spines. Length 48–50.5  $\mu$ ; breadth 36–37.5  $\mu$ ; breadth of isthmus 15–16  $\mu$ . (Tab. 25, fig. 11.) Sample 25.

197. *C. trilobulatum* Reinsch. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 185, Pl. LXII, figs. 28–30.) Samples 19, 72.

*Geographical Distribution.*—England; Scotland; Ireland; France; Germany; Hungary; North Russia; Poland; Norway; Sweden; New Zealand; Madagascar; Central and East Africa; Brazil; Japan; South Africa.

198. *C. tumidum* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. II, 1905, p. 160, Pl. LX, fig. 18.) Sample 71.

*Geographical Distribution.*—Wales; Scotland; Ireland; France; Germany (form); Norway; Sweden; Denmark; Poland; North Russia; Finland; Greenland; United States; First record for South Africa.

199. *C. waterbergense* spec. nova, affinis *C. holmiensi* Lund., sed membrana haud undulata differt.

Near *C. holmiense* Lund. (W. & G. S. West, Monogr. Brit. Desm., Vol. III, 1908, p. 1, Pl. LXV, figs. 1, 2); but differs in having crenulations. Cells rather small, about 1.5–1.8 times longer than broad, deeply constricted, sinus narrowly linear; semicells broadly pyramidal with a flattened apex, basal angles rounded. Cell wall punctate. Length 35–39  $\mu$ ; breadth 20–26.5  $\mu$ ; breadth of isthmus 8–9.5  $\mu$ ; breadth of apex 12–14  $\mu$ . (Tab. 26, figs. 1–7.) Sample 19.

*Xanthidium Ehrenberg.*

200. *X. cristatum* Bréb. var. *delpontei* Roy & Biss. forma *laevis* forma nova, differt a varietate *delpontei* et membrana cellulae omnino glabra et quod spinulae supra isthmum desunt.

A form in which the semicells are entirely destitute of a thickened or scrobiculated central area; the shape of the semicells differ slightly from the typical form (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 74, Pl. CXI, fig. 5). Length  $72\ \mu$  (with spines  $90\text{--}94\ \mu$ ); breadth  $68\ \mu$  (with spines  $80\text{--}88\ \mu$ ); breadth of isthmus  $15.5\ \mu$ . (Tab. 29, fig. 12.) Sample 74.

201. *X. cristatum* var. *transvaalense* var. nova, affinis var. *delpontei* Roy et Biss., sed cellulis multo angustioribus differt. Formae intermediae non visae.

This differs from var. *delpontei* in the narrower semicells. Cells about  $1.25\text{--}1.5$  times longer than broad; each tumour above the isthmus with a circle of  $7\text{--}10$  small spines; in some specimens there may be a spine in the centre of the circle. Length  $48\text{--}56\ \mu$ ; breadth  $38\text{--}44\ \mu$ ; breadth of isthmus  $16\text{--}18\ \mu$ ; length of spines  $8\text{--}12\ \mu$ . (Tab. 28, figs. 7–10.) Samples 24, 25.

*Straurastrum Meyen.*

202. *St. barbaricum* spec. nova, affinis *St. caffrorum* Claassen sed differt quod depressio in margine apicali deest, porro supra isthmum tantum una series spinularum adest sculpturaque membranae etiam differt.

This is near *St. caffrorum* Claassen; but differs in having no cavity in the apical margin, and in the cell wall sculpture. Cells small, about  $1.3\text{--}1.4$  times as long as broad, deeply constricted, sinus open; semicells more or less quadrangular in vertical view, with a single series of spines near the base, apical margin and angles furnished with spines. Length  $28\ \mu$ ; breadth  $20\text{--}21.5\ \mu$ ; breadth of isthmus  $7\ \mu$ . (Tab. 30, figs. 10, 11.) Sample 3.

203. *St. brevispinum* Bréb. var. *masoganum* var. nova, affinis *St. brevispino* var. *obverso* W. et G. S. West, sed sinu latiore et cellularum e vertice visarum lateribus undulatis neque concavis differt.

This variety is near var. *obversum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 148, Pl. CXXIII, fig. 7); but the sinus is broader, and the sides in vertical view are undulate and not concave. Cells small, slightly shorter than broad, deeply constricted, sinus open; semicells more or less fusiform, each apical angle furnished with a short spine. Vertical view of cell triangular, sides 3-undulate. Cell wall smooth. One pyrenoid per chloroplast. Length  $26\ \mu$ ; breadth  $28\ \mu$ ; breadth of isthmus  $8\ \mu$ . (Tab. 29, figs. 19, 20.) Sample 66.

204. *St. caffrorum* spec. nova. Inter species descriptas nulla affinitas obvia. Semicellulae e vertice visae plus minusve quadratae, margo apicalis depressione praeditus, quae spinis brevibus circumdata est. Supra isthmum duae series spinularum adsunt et anguli apicales semicellularum etiam spinulis muniti.

Cells small, about  $1.2$  times as long as broad, deeply constricted, sinus open outwards; semicells subelliptic, more or less quadrangular in vertical view, apical margin with a cavity in the median part, margin of cavity furnished with short spines; above the isthmus in each semicell are two series of small spines, apical angles furnished with spines. Length  $24\ \mu$ ; breadth  $20\ \mu$  (greatest—fig. 7) and  $16\ \mu$  (smallest—fig. 9); breadth of isthmus  $8\ \mu$ . (Tab. 30, figs. 7–9.) Sample 3.



205. *St. connatum* Roy & Biss. var. *warmbadianum* var. nova, affinis *St. connato* var. *americanum* W. et G. S. West, sed differt et semicellulis latioribus brevioribusque et quod a vertice visa latera concaviores sunt.

This closely resembles var. *americanum* W. & G. S. West (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 16, fig. 7); but the semicells are shorter and broader, and the sides in vertical view are more concave. Length 20–22  $\mu$ ; breadth 22–23  $\mu$ ; breadth of isthmus 6–7.5  $\mu$ . (Tab. 31, figs. 23, 24.) Sample 47.

206. *St. crenatum* spec. nova, affinis *St. elliptico* West, sed membrana cellulae crenata differt.

Near *St. ellipticum* West (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 138, Pl. CXIX, fig. 7); but the cell wall is crenated. Cells small, about 1.2 times as long as broad, deeply constricted, sinus widely open; semicells triangular in vertical view. Length 24–25  $\mu$ ; breadth 20–20.5  $\mu$ ; breadth of isthmus 9–10  $\mu$ . (Tab. 31, figs. 21, 22.) Samples 54, 58, 63.

207. *St. dickiei* Ralfs. (E. Messikommer, Beiträge zur geobotanischen Landesaufnahme der Schweiz, Heft 24, 1942, Taf. XII, figs. 3, 4.) Spine on apical angle straight or slightly incurved. (Tab. 31, figs. 7, 8.) Samples 59, 72.

*Geographical Distribution*.—Davos in Switzerland; Madagascar; United States; First record for South Africa.

208. *St. dilatatum* Ehrenb. (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 172, Pl. CXXVI, figs. 10–15.) Sinus less widely open than in the type and all the specimens observed were triangular in vertical view. The Rietfontein and Mosdene specimens are slightly larger than the other specimens. Length 24–40  $\mu$ ; breadth 20–36  $\mu$ ; breadth of isthmus 5–12  $\mu$ . (Tab. 30, figs. 1–6; Tab. 31, figs. 14–16.) Samples 2, 3, 12, 19, 20, 24, 27, 32, 35, 38, 41, 42, 51, 65, 66, 67, 71, 72.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Austria and Galicia; Hungary; Roumania; Servia; Macedonia; Italy; Portugal; Norway; Sweden; Denmark; Central and South Russia; Greenland; Japan; India; Ceylon; Australia; New Zealand; Madagascar; Central Africa; Azores; United States; Brazil; Bolivia; Paraguay; Argentina; South Africa.

209. *St. excavatum* W. & G. S. West. (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 8, fig. 42.) Length 12  $\mu$ ; breadth 10  $\mu$ ; length of arms 12–20  $\mu$ ; breadth of isthmus 6  $\mu$ . (Tab. 32, fig. 7.) Samples 65, 72.

*Geographical Distribution*.—Madagascar; First record for South Africa.

210. *St. furcatum* (Ehrenb.) Bréb. (F. Rich, Trans. Roy. Soc. of S. Afr., Vol. XX—Part 2, 1932, p. 175, fig. 11 A–C.) (Tab. 32, figs. 3–6.) Samples 65, 66, 74.

*Geographical Distribution*.—Davos in Switzerland; South Africa.

211. *St. galpinii* spec. nova, affinis *St. rotulae* Nordst., sed differt quod semicellula 7 tantum brachiis et margo apicalis 7 papillis est praeditus.

Near *St. rotula* Nordst. (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 18, fig. 11); but each semicell has only seven arms, and the apical margin is furnished with seven papillae. Cells of medium size, about 1.75–2.2 times longer than broad, sinus widely open; semicells with seven slightly incurved arms, each arm containing four small spines at the apex, sides crenate with a circle of spines around each crenation (not clear in some specimens); apical margin furnished with seven emarginate projections. Chloroplasts with one

central pyrenoid each. Length 38–44  $\mu$  (with papillae 46–50  $\mu$ ); breadth 18–25  $\mu$  (with arms 56–64  $\mu$ ); breadth of isthmus 10–13  $\mu$ . (Tab. 29, figs. 15–17  $\mu$ .) Samples 66, 71.

Named after Mr. E. A. Galpin of Mosdene, Naboomspruit.

212. *St. gemelliparum* Nordst. var. *africanum* var. nova, a typo speciei differt quod circulus intimus 6 brachiorum propius mediam cellulae partem dispositus est.

This closely approaches the typical form (W. & G. S. West, The Freshwater Algae of Ceylon, Trans. Linn. Soc. London, Ser. 2, Vol. VI, 1901–1902, Pl. 21, fig. 25); but in vertical view, the inner circle of six arms is nearer to the axis of the cell. Cells small, about 1.4 times as long as broad, deeply constricted, sinus open; semicells more or less elliptical, furnished with six short arms near the base and another six near the apical margin, apices of arms emarginate. Vertical view of semicell triangular, with two arms on each angle and a circular series of six arms within the margin, angles truncate. Each chloroplast containing one central pyrenoid. Length 24  $\mu$  (with arms 30  $\mu$ ); breadth 17  $\mu$  (with arms 24  $\mu$ ); breadth of isthmus 9  $\mu$ . (Tab. 32, figs. 1, 2.) Sample 66.

213. *St. leptocladum* Nordst. var. *cornutum* Wille. These specimens are larger than in the typical form (W. & G. S. West, Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Vol. V, 1895–1901, Pl. 9, figs. 12, 13; F. Rich, Trans. Roy. Soc. of S. Afr., Vol. XX—Part 2, 1932, p. 175, fig. 13 F). Length 38–41  $\mu$ ; breadth 11–14  $\mu$  (with processes 72–108  $\mu$ ); breadth of isthmus 8–9  $\mu$ . (Tab. 32, fig. 8.) Sample 74.

*Geographical Distribution*.—Madagascar; South Africa.

214. *St. mattiei* spec. nova. Nulla affinitate notata. Cellulae parva, aliquanto latiores quam longiores, sinu foras aperto, membrana spinulis praecipue in angulis apicalibus praedita, semicellula e vertice visa lateribus concavis triangulata.

Cells small, slightly shorter than broad, deeply constricted, sinus open. Vertical view of semicell triangular, sides concave. Cell wall furnished with short spines, mainly on the apical angles. Length 17.5–26  $\mu$ ; breadth 19.5–28  $\mu$ ; breadth of isthmus 6–14  $\mu$ ; length of spines 3–4  $\mu$ . (Tab. 31, figs. 25–27.) Sample 24.

215. *St. mesianum* spec. nova. Cum sp. *St. subgemmauto* W. et G. S. West congruit quod semicellulis sena brachia sunt, quae tamen glabra sunt, spinula utrimque ad basim tantum praedita.

Near *St. subgemmauto* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 8, fig. 34) in that each semicell contains six arms, but the arms are smooth and furnished with a small spine on each side at the base. Cells moderately constricted, sinus open; semicells with six gradually attenuated arms, with four small spines at the apex of each arm. Cell wall smooth. Each chloroplast with one pyrenoid. Length 28–29  $\mu$ ; breadth 20–21  $\mu$  (with arms 43–44  $\mu$ ); breadth of isthmus 10–12  $\mu$ . (Tab. 31, figs. 3, 4.) Sample 59.

Named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

216. *St. orbiculare* Ralfs var. *ralfsii* W. & G. S. West. (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 156, Pl. CXXXIV, figs. 12–16.) Cells slightly smaller than in the typical form. Length 26  $\mu$ ; breadth 21  $\mu$ ; breadth of isthmus 7.5–8  $\mu$ . (Tab. 30, figs. 14, 15.) Sample 60.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Switzerland; Austria and Galicia; Hungary; Serbia; Italy; Portugal; Norway; Sweden; Denmark; Bornholm; Finland; Poland; North, Central and

South Russia; Faeroes; Iceland; Nova Zembla; Spitzbergen; Greenland; East and North India; Australia; United States; Bolivia; Paraguay; Argentina; Patagonia; Brazil; First record for South Africa.

217. *St. orbiculare* var. *waterbergense* var. nova, affinis *St. orbiculari* var. *hibernico* W. et G. S. West, sed lateralibus, a vertice visis, concavis differt.

Near var. *hibernicum* W. & G. S. West (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 156, Pl. CXXIV, figs. 5-9); but differs in that the sides are concave in vertical view. Length 31-33  $\mu$ ; breadth 28-30  $\mu$ ; breadth of isthmus 7.5-9  $\mu$ . (Tab. 31, figs. 5, 6.) Samples 52, 54, 58.

218. *St. pseudogemmulum* spec. nova, affinis *St. subgemma* W. et G. S. West, sed differt et brachiis leviter incurvatis et quod semicellulis a vertice visis binae sunt granulorum series, quae circuli modo dispositae ternis consistunt granulis. Circulo interiori sex eiusmodi sunt series, exteriori tamen duodecim.

This differs from *St. subgemma* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895-1901, Pl. 8, fig. 34) in having slightly incurved arms and in the cell wall sculpture. Cells small, about 1.6-1.7 times longer than broad, sinus open; semicells with six arms, apex of each arm emarginate. Cell wall, in vertical view of semicell, with two circular series of granules arranged in groups of three granules each, inner circle consists of six groups and outer circle contains 12 groups; and with three circles of granules around each arm. Each chloroplast contains a central pyrenoid. Length 29-32  $\mu$ ; breadth 17-19  $\mu$  (with arms 33-34  $\mu$ ); breadth of isthmus 10-11  $\mu$ . (Tab. 31, figs. 9, 10.) Sample 19.

219. *St. pseudogemmulum* var. *warmbadianum* var. nova, affinis *St. pseudogemmulum* Claassen, sed brachiis quam prioris varietatis longioribus tenuioribusque differt, quae a vertice visa 4 granula singulis in seriebus ad interiorem circumulum habent.

Arms longer and narrower than in *St. pseudogemmulum* Claassen; cell wall with the inner series of granules consisting of four granules per group. Length 28.5-32  $\mu$ ; breadth 16-17  $\mu$  (with arms 34-37  $\mu$ ); breadth of isthmus 7.5-9  $\mu$ . (Tab. 31, figs. 11-13.) Sample 48.

220. *St. pygmaeum* Bréb. var. *botesii* var. nova, affinis var. *apiculato* W. et G. S. West, sed angulis apicalibus spinalis munitis, ceteroquin omnino glabra differt.

This differs from var. *apiculatum* W. & G. S. West (W. & G. S. West, Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895-1901, Pl. 8, fig. 26) in the cell wall being smooth except for the apical angles, which contains a few spines. Cells small, about as long as broad, deeply constricted, sinus open; semicells with three spines on the apical angles and a circle of spines near the angles. Vertical view triangular. Length 26-28  $\mu$ ; breadth 25.5-26  $\mu$ ; breadth of isthmus 8.5-10  $\mu$ . (Tab. 31, figs. 28, 29.) Sample 24.

Named after Mr. P. W. Botes of Moddernek, Nylstroom.

221. *St. quadrangulare* Bréb. var. *subarmatum* var. nova, affinis *St. quadrangulare* var. *armato* W. et G. S. West, sed sinu latiore, spinulis longioribus, et cellulis multo maioribus differt; semicellulae e vertice visae triangulatae.

This differs from var. *armatum* W. & G. S. West (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895-1901, Pl. 16, fig. 18) in having a broader sinus, longer spines and considerably larger cells; semicells triangular in vertical view. Fig. 18 shows the cell in front view; it was impossible to keep the cell in vertical position in order to illustrate it. Length 32  $\mu$ ; breadth 41-43  $\mu$  (with spines 48-50  $\mu$ ); breadth of isthmus 14-14.5  $\mu$ . (Tab. 29, fig. 18.) Samples 68, 71.



222. *St. setigerum* Cleve var. *pectinatum* W. et G. S. West forma *australe* forma nova. A var. *pectinato* W. et G. S. West isthmo multo latiore differt.

This form differs from var. *pectinatum* (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 16, fig. 28) in that the isthmus is about 2·2 times broader. Length  $33\ \mu$  (with spines  $46\ \mu$ ); breadth  $32\ \mu$  (with spines  $48\ \mu$ ); breadth of isthmus  $14\ \mu$ . (Tab. 29, figs. 13, 14.) Sample 65.

223. *St. subgemmaulatum* W. & G. S. West var. *mattiei* var. nova, affinis var. *gracilis* W. et G. S. West, sed cellulae brachiis longioribus tenuioribusque praeditae eam distinguunt.

These specimens are near var. *gracilis* W. & G. S. West (W. & G. S. West, The Freshwater Algae of Madagascar, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 8, fig. 35); but differ in possessing longer and narrower arms. Length  $32$ – $32\cdot5\ \mu$ ; breadth  $15$ – $17\ \mu$  (with arms  $43\cdot5$ – $46\ \mu$ ); breadth of isthmus  $10$ – $11\ \mu$ . (Tab. 31, figs. 1, 2.) Sample 59.

224. *St. subtrifurcatum* West forma *major* W. & G. S. West. These specimens are larger than in the typical form (W. Schmidle, Engler Bot. Jahrb., XXXII Bd., 1903, p. 73, Taf. II, fig. 8). Length  $72$ – $76\ \mu$ ; breadth  $58$ – $62\ \mu$ ; breadth of isthmus  $24$ – $26\cdot5\ \mu$ ; length of spines  $20$ – $36\ \mu$ . (Tab. 30, figs. 16–18.) Samples 24, 25, 39.

*Geographical Distribution*.—Central Africa; First record for South Africa.

225. *St. teliferum* Ralfs var. *transvaalense* var. nova. A typo speciei spinulis hebetatis differt.

This is near *St. teliferum* Ralfs (E. Messikommer, Beiträge zur geobotanischen Landesaufnahme der Schweiz, Heft 24, 1942, Taf. XIV, fig. 8); but differs in the spines being blunt. Length  $30\cdot5$ – $31\ \mu$ ; breadth  $28\ \mu$ ; breadth of isthmus  $11$ – $13\ \mu$ ; length of spines  $2\cdot5$ – $4\ \mu$ . (Tab. 31, figs. 19, 20.) Sample 19.

This may also be compared with *St. breviaculeatum* G. M. Smith (Wm. R. Taylor, Alpine Algae from the Santa Marta Mountains, Colombia., Am. Journ. of Bot., Vol. 22, 1935, p. 772, Pl. 2, fig. 5).

226. *St. trihedrale* Wolle var. *australe* var. nova. A typo speciei isthmo multo latiore differt.

This differs from the typical form (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 16, fig. 29) in that the isthmus is 1·5 times broader. Length  $44\ \mu$ ; breadth  $30\ \mu$ ; breadth of isthmus  $14$ – $15\cdot5\ \mu$ . (Tab. 31, figs. 17, 18.) Sample 27.

227. *St. tunidum* Bréb. (W. & G. S. West, Monogr. Brit. Desm., Vol. IV, 1912, p. 142, Pl. CXXII, figs. 1–5.) Sample 71.

*Geographical Distribution*.—England; Wales; Scotland; Ireland; France; Germany; Galicia in Austria; Norway; Denmark; Sweden; Bornholm; United States; First record for South Africa.

228. *St. xiphidiophcrum* Wolle var. *westiorum* var. nova. E vertice visae cellulae cum var. *brachyacantho* W. et G. S. West valde congruunt, sed differt spinis in angulis apicalibus multo brevioribus.

This closely resembles var. *brachyacanthum* W. & G. S. West (W. & G. S. West, North American Desmidiaceae, Trans. Linn. Soc. London, Ser. 2, Bot., Vol. V, 1895–1901, Pl. 18, fig. 7) in vertical view; but the spines on the apical angles are much shorter and the cells are smaller. Cells small, about 1·3 times as long as broad, fairly deeply constricted, sinus open; basal and apical angles of semicells truncate and furnished



with a few spines. Semicells more or less triangular in vertical view; each angle with three spines (it seems to be 9-angular). Length  $24\ \mu$ ; breadth  $18.5\text{--}19\ \mu$ ; breadth of isthmus  $10\text{--}10.5\ \mu$ . (Tab. 30, figs. 12, 13.) Sample 3.

Named after Messrs. W. & G. S. West.

### *Sphaerosoma Corda*

229. *Sph. aubertianum* W. West. Cells somewhat smaller than in the type (W. West, Journ. of Bot., Vol. XXVII, 1889. Tab. 291, fig. 17). Length  $10\text{--}12\ \mu$ ; breadth  $13\text{--}16\ \mu$ ; breadth of isthmus  $5\text{--}6\ \mu$ . (Tab. 32, fig. 9.) Sample 74.

*Geographical Distribution*.—Maine; First record for South Africa.

### *Onychonema G. C. Wallich*

230. *Onychonema* species ad *O. laeve* Nordst. var. *micracanthum* Nordst. The cells correspond with those in Nordstedt's variety except for the somewhat undulated apical margin in some specimens; this may be due to the fixative as other specimens from the fresh material have smooth apical margins. Unfortunately the measurements of Nordstedt's variety are not available. Length  $16\text{--}18\ \mu$ ; breadth  $20\text{--}24\ \mu$  (with spines  $24\text{--}30\ \mu$ ); breadth of isthmus  $4\text{--}4.5\ \mu$ . (Tab. 32, fig. 10.) Sample 74.

## TRIBUS: BACILLARIOPHYTA

The different Diatom taxa have been determined by Dr. B. J. Cholnoky and the descriptions and figures have been published by him. (Beiträge zur Kenntnis der Südafrikanischen Diatomeenflora II. Einige Gewässer im Waterberg-Gebiet, Transvaal. Portugaliae Acta Biologica (Série B) Vol. 6, No. 2, 1958, pp. 99–160, Taf. I–VII. The diatoms of the following samples have not been determined as yet:

30, 36, 37, 38, 39, 41, 42, 43, 44, 66, 67, 68, 69, 70, 71, 72, 73, 74.

*Class*: Diatomeae.

*Order*: Centrales.

*Suborder*: Discineae.

*Fam.*: Coscinodiscaceae.

*Subfam.*: Melosiroideae.

### *Melosira Agardh.*

231. *M. granulata* (E.) Ralfs. Samples 47, 48, 49, 50, 57.  
 232. *M. nyassensis* O.M. Sample 12.  
 233. *M. roeseana* Rabh. Sample 51.

*Subfam.*: Coscinodiscoideae.

### *Cyclotella Kutë.*

234. *C. kützingiana* Thw. Sample 50.

Order: Pennales.

Suborder: Araphidineae.

Fam.: Fragilariaceae.

Subfam.: Fragilarioideae.

**Fragilaria** *Lynghye*

235. *F. capucina* Desm. var. *acuta* Grun. Sample 63.

236. *F. fonticola* Hust. Sample 1.

237. *F. ungeriana* Grun. Sample 63.

**Asterionella** *Hassall*

238. *A. africana* Chy. Sample 49.

**Synedra** *Ehrenberg*

239. *S. acus* Kg. var. *radians* (Kg.) Hust. Samples 7, 59, 60.

240. *S. rumpens* Kg. Samples 1, 4, 5, 7, 8, 10, 11, 12, 60, 63, 64.

241. *S. rumpens* var. *fragilarioides* Grun. Samples 9, 11, 18.

242. *S. rumpens* var. *meneghiniana* Grun. Samples 5, 7, 8, 10, 11, 12, 23, 47, 63, 64.

243. *S. rumpens* var. *scotica* Grun. Sample 50.

244. *S. ulna* (Nitzsch) E. Samples 1, 4, 5, 6, 8, 9, 11, 15, 18, 19, 20, 23, 32, 46, 47, 48, 49, 50, 51, 52, 53, 55, 57, 58, 60, 63, 64.

245. *S. ulna* var. *biceps* (Kg.) Hust. Samples 1, 5, 6, 7, 8, 12, 13, 47, 48, 50, 60, 63.

246. *S. ulna* var. *danica* (Kg.) Grun. Samples 7, 63, 64.

247. *S. vaucheriae* Kg. Sample 6.

Suborder: Raphidioideae.

Fam.: Eunotiaceae.

Subfam.: Eunotioideae.

**Eunotia** *Ehrenberg*

248. *E. alpina* (Näg.) Hust. Sample 24.

249. *E. exigua* (Bréb.) Grun. Samples 2, 3, 24, 25, 26, 27, 28, 29, 33, 35, 45, 46, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.

250. *E. garusica* Chy. Samples 47, 60.

251. *E. lunaris* (E.) Grun. Sample 60.

252. *E. lunaris* var. *subarcuata* (Näg.) Grun. Sample 51.

253. *E. mogolensis* Chy. Samples 25, 26, 27, 28, 45, 52.

254. *E. montana* Hust. Sample 45.

255. *E. pectinalis* (Kg.) Rabh. Samples 26, 28, 46, 52, 58, 64.

256. *E. pectinalis* var. *minor* (Kg.) Rabh. Samples 46, 52, 54, 55, 56, 57, 58.

257. *E. porcellus* Chy. Sample 25.

258. *E. praerupta* E. var. *inflata* Grun. Sample 54.

259. *E. pseudoflexuosa* Hust. Samples 45, 54, 57.

260. *E. subaequalis* Hust. Samples 23, 25, 26, 27, 28, 29, 35, 45, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 59, 63, 64.

261. *E. tenella* (Grun.) Hust. Samples 3, 24, 25, 26, 27, 28, 29, 34, 35, 45, 46, 51, 52, 53, 54, 55, 56, 57, 58, 63.

262. *E. tschirchiana* O.M. Sample 7.

263. *E. zygodon* E. Samples 25, 26, 27, 28, 45.

264. *E. zygodon* var. *elongata* Hust. Samples 26, 27, 28, 29.

Suborder: Monoraphidineae.

Fam.: Achnanthaceae.

Subfam.: Achnanthoideae.

**Achnanthes Bory**

265. *A. exigua* Grun. Samples 6, 63.

266. *A. lanceolata* (Bréb.) Grun. var. *rostrata* Hust. Sample 51.

267. *A. linearis* W. Sm. Samples 13, 14, 15, 32.

268. *A. microcephala* Kg. Samples 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 20, 22, 23, 29, 32, 33, 45, 47, 49, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.

269. *A. minutissima* Kg. Samples 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 22, 23, 29, 32, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.

Suborder: Biraphidineae.

Fam.: Naviculaceae.

Subfam.: Naviculoideae.

**Frustulia Agardh.**

270. *F. rhomboides* (E.) de Toni. Samples 23, 45, 46, 51, 52, 53, 54, 55, 57, 58.

271. *F. rhomboides* var. *saxonica* (Rabh.) de Toni. Samples 12, 14, 20, 29, 32, 45, 47, 50, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.

272. *F. vulgaris* (Thw.) de Toni var. *angusta* Chy. Samples 1, 7, 9, 11, 12, 13, 14, 15, 47, 50, 53, 54, 55, 57, 60, 63, 64.

**Gyrosigma Hassall**

273. *G. kützingii* (Grun.) Cl. Samples 1, 7, 10, 12, 13, 15, 18, 20, 23, 47, 48, 49, 50, 62.

274. *G. spenceri* (W. Sm.) Cl. var. *nodifera* Grun. Sample 6.

**Caloneis Cleve**

275. *C. aequatorialis* Hust. var. *tugelae* Chy. Samples 14, 15, 62.

276. *C. bacillum* (Grun.) Cl. Samples 13, 15, 20, 63.

277. *C. chasei* Chy. Sample 22.

278. *C. incognita* Hust. Samples 14, 15, 16, 47.

279. *C. silicula* (E.) Cl. Samples 12, 14, 64.

280. *C. silicula* var. *peisonis* Hust. Samples 47, 50.

281. *C. silicula* var. *truncatula* Grun. Samples 14, 47, 48, 49, 50, 53, 56.

**Neidium Pfitzer**

282. *N. affine* (E.) Cl. Samples 6, 7, 19, 25, 26, 33, 46, 54, 60.

283. *N. affine* var. *amphirhynchus* (E.) Cl. Samples 28, 46, 48, 52, 53, 54, 55, 56, 59.

284. *N. affine* var. *longiceps* (Greg.) Cl. Samples 12, 52, 53, 56, 57.

285. *N. gracile* Hust. Samples 46, 52.

286. *N. gracile* forma *aequale* Hust. Samples 29, 45, 46.

287. *N. iridis* (E.) Cl. Samples 26, 33, 47, 48, 49, 53, 54, 55, 57, 59, 63, 64.

288. *N. iridis* var. *amphigomphus* (E.) van Heurck. Samples 25, 26, 28.

289. *N. iridis* var. *ampliata* (E.) Cl. Sample 56.

290. *N. javanicum* Hust. Sample 58.

291. *N. productum* (W. Sm.) Cl. Samples 14, 15, 26, 46, 54, 56, 58, 63, 64.

**Diploneis Ehrenberg**

292. *D. ovalis* (Hilse) Cl. Sample 59.  
 293. *D. subovalis* Cl. Sample 52.

**Stauroneis Ehrenberg**

294. *S. anceps* E. Samples 6, 19, 20, 23, 47, 50, 51, 53, 54, 56, 63.  
 295. *S. anceps* forma *gracilis* (E.) Cl. Samples 46, 52, 53, 54, 55, 56, 58, 64.  
 296. *S. borrichi* (Petersen) Lund. Samples 53, 56.  
 297. *S. claasseniae* Chy. Sample 59.  
 298. *S. crucicula* Grun. Sample 1.  
 299. *S. phoenicenteron* E. Samples 24, 25, 26, 28, 29, 33, 46, 48, 51, 52, 54, 55, 56, 57, 59, 60.  
 300. *S. phoenicenteron* forma *gracilis* (Dippel) Hust. Samples 45, 56.

**Anomoeoneis Pfitzer**

301. *A. exilis* (Kg.) Cl. Samples 1, 5, 7, 8, 9, 10, 11, 12, 14, 20, 23, 63.  
 302. *A. sphaerophora* (Kg.) Pfitzer. Samples 59, 60.

**Navicula Bory**

303. *N. acidophila* Chy. Sample 24.  
 304. *N. anglica* Ralfs. Samples 12, 13, 14, 16, 20, 22, 47, 48, 49, 50.  
 305. *N. bryophila* Petersen. Samples 5, 6, 9, 10, 11, 25, 26, 27, 45.  
 306. *N. cari* E. Samples 13, 17, 46, 59, 61, 62.  
 307. *N. cari* var. *angusta* Grun. Samples 20, 21, 22, 26, 46, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.  
 308. *N. cincta* (E.) Kg. Samples 14, 15, 20, 46, 49, 61, 62.  
 309. *N. cinctaeformis* Hust. Sample 61.  
 310. *N. confervacea* Kg. Samples 47, 48.  
 311. *N. cryptocephala* Kg. Samples 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 24, 25, 26, 28, 29, 32, 33, 34, 35, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64.  
 312. *N. cryptocephala* var. *intermedia* Grun. Samples 6, 63.  
 313. *N. cryptocephala* var. *veneta* (Kg.) Grun. Sample 57.  
 314. *N. cuspidata* Kg. Samples 48, 49, 53, 54, 58, 59, 63.  
 315. *N. cuspidata* var. *ambigua* (E.) Cl. Samples 15, 20, 21, 22, 46, 49, 51, 55, 56, 57, 59, 60, 63, 64.  
 316. *N. dicephala* (E.) W. Sm. Samples 15, 48.  
 317. *N. dicephala* var. *neglecta* (Krasske) Hust. Sample 50.  
 318. *N. elaborata* Hust. Sample 35.  
 319. *N. exigua* (Greg.) O.M. Samples 1, 13, 20, 47, 48, 50.  
 320. *N. exiguiformis* Hust. Samples 51, 63.  
 321. *N. gastrum* E. Samples 51, 52, 53, 54, 55, 57, 58.  
 322. *N. graciloides* A. Mayer. Sample 7.  
 323. *N. gregaria* Donk. Samples 2, 32, 47, 50, 51, 59.  
 324. *N. gregarioides* Chy. Samples 21, 23, 26, 46, 51, 52, 53, 54, 55, 56, 57, 58, 60, 63.  
 325. *N. grinnmei* Krasske. Samples 1, 4, 13, 35, 47, 48, 59, 63, 64.  
 326. *N. hungarica* Grun. var. *capitata* (E.) Cl. Samples 1, 20, 48.  
 327. *N. krasskei* Hust. Samples 25, 29.  
 328. *N. lanceolata* (Ag.) Kg. Samples 15, 47, 48, 49, 50, 59, 60.  
 329. *N. longicephala* Hust. Samples 55, 56.  
 330. *N. mengineae* Chy. Sample 57.



331. *N. menisculus* Schum. Samples 6, 11, 13.
332. *N. microcephala* Grun. Sample 50.
333. *N. minima* Grun. var. *atomooides* (Grun.) Cl. Sample 46.
334. *N. minuscula* Grun. Sample 47.
335. *N. minusculoides* Hust. Samples 60, 61.
336. *N. muralis* Grun. Samples 2, 24, 49.
337. *N. mutica* Kg. Samples 7, 8, 25, 26, 27, 29, 31, 35, 51, 56, 57, 63.
338. *N. mutica* forma *cohnii* (Hilse) Hust. Samples 3, 4, 8, 19, 20, 27, 29, 34.
339. *N. mutica* var. *nivalis* (E.) Hust. Samples 1, 7, 10, 19, 20, 21, 33, 35, 51, 53, 55, 56.
340. *N. mutica* var. *pseudolagerheimii* Chy. Samples 11, 28, 45, 48, 55, 58, 63.
341. *N. nyassensis* O.M. Samples 12, 13, 54, 56, 57, 58, 63.
342. *N. nyassensis* var. *capitata* O.M. Sample 63.
343. *N. nyassensis* var. *minor* Chy. Samples 13, 14, 15, 16, 20, 23, 52, 59, 61, 62.
344. *N. perpusilla* Grun. Samples 25, 27, 28.
345. *N. pupula* Kg. Samples 46, 54, 56, 60, 61, 62, 63, 64.
346. *N. pupula* var. *capitata* Hust. Samples 47, 48, 49, 50, 55, 64.
347. *N. pupula* var. *rectangularis* (Greg.) Grun. Sample 63.
348. *N. pygmaea* Kg. Samples 59, 60.
349. *N. radiosa* Kg. Samples 7, 8, 11, 12, 46, 47, 48, 52, 53, 54, 55, 57, 58, 63, 64.
350. *N. radiosa* var. *tenella* (Bréb.) Grun. Samples 9, 11, 25, 32, 33, 35, 45, 47, 48, 49, 50, 52, 54, 55, 57, 58, 59, 60, 63, 64.
351. *N. rhynchocephala* Kg. Samples 7, 13, 14, 15, 48, 60.
352. *N. rutneri* Hust. Sample 33.
353. *N. schroeteri* Meister. Samples 1, 7, 9, 10, 12, 14, 47, 48, 50.
354. *N. seminuloides* Hust. Sample 7.
355. *N. seminuloides* var. *sumatrana* Hust. Samples 29, 45.
356. *N. seminulum* Grun. Samples 29, 32, 33, 49, 59, 60.
357. *N. simplex* Krasske var. *minor* Chy. Samples 20, 22, 23, 52, 53, 54, 55, 56, 58.
358. *N. subtilissima* Cl. Samples 3, 52, 56.
359. *N. suecorum* Carlson. Samples 19, 64.
360. *N. tenelloides* Hust. Samples 19, 21, 29, 31, 32, 33, 35, 45, 46, 62.
361. *N. terrestris* Petersen. Samples 63, 64.
362. *N. tridentula* Krasske. Sample 60.
363. *N. viridula* Kg. Samples 1, 60.
364. *N. viridula* var. *linearis* Hust. Sample 1.
365. *N. viridula* var. *rostellata* (Kg.) Cl. Samples 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 23, 28, 47, 48, 49, 50, 51, 60, 62, 63, 64.
366. *N. vulpina* Kg. Sample 59.
367. *N. zaroni* Hust. Samples 1, 5, 7, 8, 9, 10, 11, 12, 13, 47, 50.

#### ***Pinnularia Ehrenberg***

368. *P. acoricola* Hust. Samples 25, 29, 45.
369. *P. acrosphaeria* Bréb. Samples 5, 14, 15, 59.
370. *P. acrosphaeria* var. *controversa* Chy. Sample 59.
371. *P. amaniensis* Hust. Samples 25, 26, 28.
372. *P. borealis* E. Sample 23.
373. *P. braunii* (Grun.) Cl. Samples 54, 58.
374. *P. braunii* var. *amphicephala* (A. Mayer) Hust. Sample 45.
375. *P. claasseniae* Chy. Sample 35.
376. *P. dactylus* E. Sample 45.
377. *P. divergens* W. Sm. Samples 14, 15, 20, 47, 50, 54.
378. *P. divergens* var. *undulata* Hérib. & Perag. Sample 13.
379. *P. dubitabilis* Hust. Samples 2, 3, 12, 20, 24, 25, 27, 28, 29, 33, 35, 45, 47, 48, 53, 55, 57, 60, 63, 64.

380. *P. gibba* E. Samples 6, 7, 11, 14, 15, 20, 25, 26, 27, 28, 29, 33, 45, 46, 47, 48, 49, 50, 51, 52, 54, 56, 57, 58, 59, 61, 63, 64.
381. *P. gibba* forma *subundulata* Mayer. Samples 16, 31, 33, 47, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 63, 64.
382. *P. gibba* var. *parva* (E.) Grun. Samples 4, 7, 9, 11, 13, 14, 15, 19, 25, 26, 27, 28, 29, 31, 33, 35, 45, 51, 63, 64.
383. *P. gibba* var. *sancta* Grun. Samples 25, 28, 33, 50, 51, 54, 55, 56, 59, 63.
384. *P. graciloides* Hust. Samples 4, 23.
385. *P. interrupta* W. Sm. Samples 23, 25, 26, 27, 28, 29, 32, 33, 63.
386. *P. interrupta* var. *minutissima* Hust. Samples 7, 24.
387. *P. maior* (Kg.) Cl. Samples 13, 14, 15, 58.
388. *P. mesolepta* (E.) W. Sm. Sample 19.
389. *P. microstauron* (E.) Cl. Sample 64.
390. *P. microstauron* forma *biundulata* O.M. Sample 48.
391. *P. microstauron* var. *brébissonii* (Kg.) Hust. Sample 19.
392. *P. ruttneri* Hust. Samples 25, 28.
393. *P. subcapitata* Greg. Samples 2, 3, 9, 12, 19, 20, 22, 23, 25, 27, 28, 29, 31, 32, 33, 34, 35, 45, 50, 51, 52, 53, 54, 55, 60, 64.
394. *P. subcapitata* var. *hilseana* (Janisch) O.M. Samples 2, 4, 7, 10, 11, 12, 25, 28, 31, 32, 33, 34, 35, 45, 46, 48, 50, 51, 52, 53, 54, 55, 56, 57.
395. *P. viridis* (Nitzsch) E. Samples 4, 12, 13, 14, 15, 16, 20, 27, 28, 33, 47, 48, 49, 50, 52, 53, 54, 56, 57, 58, 59, 63, 64.
396. *P. viridis* var. *sudetica* (Hilse) Hust. Sample 33.

*Subfam.: Amphiproroideae.*

***Amphora* Ehlenberg**

397. *A. ovalis* Kg. Samples 12, 14, 59.
398. *A. ovalis* var. *libyca* (E.) Cl. Samples 47, 48, 49, 50.
399. *A. submontana* Hust. Samples 11, 13, 14, 15, 16, 23, 46, 47, 48, 49, 50, 62.

***Cymbella* Agardh.**

400. *C. amphicephala* Näg. Sample 29.
401. *C. amphicephala* var. *hercynica* (N.S.) Cl. Sample 26.
402. *C. bengalensis* Grun. Sample 63.
403. *C. cistula* (Hempr.) Grun. Samples 5, 6, 7, 8, 9, 14.
404. *C. cistula* var. *african.* Chy. Samples 11, 12.
405. *C. clauseniae* Chy. Samples 25, 26, 28, 51, 54, 56, 58.
406. *C. gracilis* (Rabh.) Cl. Samples 7, 14, 15, 52.
407. *C. javanica* Hust. Sample 32.
408. *C. kappii* Chy. Samples 1, 5, 7, 8, 9, 10, 11, 12.
409. *C. kolbei* Hust. Samples 1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 20, 47, 50, 63, 64.
410. *C. microcephala* Grun. Samples 1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 20, 23, 45, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.
411. *C. mülleri* (O.M.) Hust. Sample 7.
412. *C. naviculiformis* Auersw. Samples 13, 14, 18, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.
413. *C. nylstrooimensis* Chy. Sample 63.
414. *C. pretoriensis* Chy. Samples 21, 24, 25, 26, 27, 28, 29.
415. *C. pseudoincerta* Chy. Sample 29.
416. *C. raytonensis* Chy. Samples 22, 25, 26, 27, 28, 29, 52.
417. *C. raytonensis* var. *debegenica* Chy. Sample 21.
418. *C. spicula* Hust. Sample 64.
419. *C. spuria* Cl. Samples 8, 46.

420. *C. turgida* (Greg.) Cl. Samples 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 23, 34, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.  
 421. *C. turgida* forma *minor* Chy. Samples 7, 22, 23, 50, 52, 53, 55, 57, 58, 59, 60, 63.  
 422. *C. turgida* var. *pseudogracilis* Chy. Sample 63.  
 423. *C. ventricosa* Kg. Samples 1, 5, 7, 8, 9, 10, 11, 12, 13, 18, 19, 20, 22, 23, 29, 32, 33, 34, 35, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64.

### **Gomphonema Agardh.**

424. *G. acuminatum* E. var. *turris* (E.) Cl. Sample 7.  
 425. *G. augur* E. Sample 52.  
 426. *G. clevei* Fricke. Samples 9, 50, 63, 64.  
 427. *G. constrictum* E. Samples 57, 60, 63, 64.  
 428. *G. gracile* E. Samples 1, 4, 6, 7, 8, 9, 11, 12, 13, 14, 15, 18, 23, 24, 25, 26, 28, 29, 32, 46, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.  
 429. *G. gracile* var. *lanceolatum* (Kg.) Cl. Samples 7, 9, 12, 51, 59, 60, 63, 64.  
 430. *G. lanceolatum* E. Samples 4, 5, 6, 9, 10, 11.  
 431. *G. parvulum* (Kg.) Grun. Samples 2, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 20, 23, 26, 29, 32, 33, 35, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 63, 64.  
 432. *G. parvulum* var. *lagenula* (Grun.) Hust. Samples 1, 2, 4, 5, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25, 28, 29, 31, 32, 33, 34, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 63, 64.  
 433. *G. subtile* E. Samples 7, 26, 28, 33.

Fam.: Epithemiaceae.

Subfam.: Epithemioidae.

### **Epithemia Brébisson**

434. *E. zebra* (E.) Kg. Sample 7.

Subfam.: Rhopalodioideae.

### **Rhopalodia O. Müller**

435. *R. gibba* (E.) O.M. Samples 4, 6, 9, 11, 12, 13, 14, 23, 47, 48, 49, 50, 62.

Fam.: Nitzschiaceae.

Subfam.: Nitzschioidae.

### **Hantzschia Grunow**

436. *H. amphioxys* (E.) Grun. Samples 11, 12, 17, 20, 23, 33, 56, 59, 60, 62, 64.  
 437. *H. amphioxys* var. *africana* Hust. forma *minuta* Chy. Samples 1, 3, 4, 21, 25, 26, 27, 28, 29, 31, 34, 35, 48, 49, 51, 52, 55, 57, 58, 63.  
 438. *H. amphioxys* var. *intermedia* Grun. Samples 20, 57, 58, 59, 63.  
 439. *H. amphioxys* var. *vivax* (Hantzsch) Grun. Samples 20, 26, 27, 29, 47, 48, 49, 53, 55, 56, 57, 59.

### **Nitzschia Hassal**

440. *N. accommodata* Hust. Samples 1, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 20, 22, 23, 25, 26, 27, 28, 32, 33, 34, 46, 47, 48, 49, 51, 53, 54, 58, 59, 60, 61, 62, 63.  
 441. *N. amphibia* Grun. Samples 48, 50.  
 442. *N. capitellata* Hust. Samples 1, 33, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 62, 64.

443. *N. claasseniae* Chy. Samples 1, 5, 7, 12, 20, 23, 57, 58, 59, 60.  
 444. *N. clausii* Hantzsch. Samples 1, 13, 14, 15, 18, 47, 50, 63.  
 445. *N. confinis* Hust. Samples 7, 13, 48.  
 446. *N. debilis* (Arnott) Grun. Sample 63.  
 447. *N. denticula* Grun. Sample 22.  
 448. *N. diserta* Hust. Sample 5.  
 449. *N. dissipata* (Kg.) Grun. Samples 1, 16.  
 450. *N. fonticola* Grun. Samples 9, 13, 17, 19, 21, 23, 28, 29, 31, 32, 33, 34, 35, 45, 46, 49.  
 451. *N. frustulum* (Kg.) Grun. var. *perpusilla* (Rabh.) Grun. Samples 5, 12, 18, 19, 20, 22, 60.  
 452. *N. goetzeana* O.M. Samples 13, 14, 59.  
 453. *N. kützingiana* Hilse. Samples 46, 47, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62.  
 454. *N. linearis* (Ag.) W. Sm. Samples 1, 5, 7, 9, 11, 13, 14, 15, 16, 47, 48, 49, 50, 51, 59, 60, 62, 64.  
 455. *N. palea* (Kg.) W. Sm. Samples 2, 5, 11, 12, 24.  
 456. *N. palea* var. *tropica* Host. Sample 49.  
 457. *N. purvuloides* Chy. Samples 21, 26, 32, 45, 53.  
 458. *N. perminuta* Grun. Samples 46, 53, 55, 56, 58, 59, 60, 61, 62.  
 459. *N. pseudobacata* Chy. Sample 47.  
 460. *N. recta* Hantzsch. Sample 1.  
 461. *N. romana* Grun. Sample 59.  
 462. *N. sigma* (Kg.) W. Sm. Samples 1, 20, 23, 47, 48, 50.  
 463. *N. subadapta* Chy. Sample 12.  
 464. *N. subcommunis* Hust. Sample 50.  
 465. *N. subvitrea* Hust. Samples 14, 47, 49.  
 466. *N. tarda* Hust. Samples 8, 20, 23, 47, 49, 55, 56, 59, 60.  
 467. *N. transvaalensis* Chy. Sample 59.  
 468. *N. tropica* Hust. Samples 1, 4, 19, 20, 22, 23.  
 469. *N. tryblionella* Hantzsch var. *levidensis* (W. Sm.) Grun. Samples 1, 7, 59.  
 470. *N. von-hauseniae* Chy. Samples 20, 25, 26, 32, 33, 63, 64.

Fam.: Surirellaceae.

Subfam.: Surirelloideae.

#### *Cymatopleura* W. Smith

471. *C. solea* (Bréb.) W. Sm. Samples 12, 14.

#### *Stenopterobia* Brébisson

472. *S. intermedia* (Lewis) Hust. Samples 25, 26, 27, 28, 46.  
 473. *S. rautenbachiae* Chy. Sample 64.

#### *Surirella* Turpin

474. *S. angusta* Kg. Samples 1, 7, 13, 14, 15, 20, 47, 48, 50, 59, 60, 61, 62, 63, 64.  
 475. *S. delicatissima* Lewis. Samples 22, 24, 26, 27, 28, 32, 34, 35, 45, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64.  
 476. *S. linearis* W. Sm. Samples 1, 46, 56, 58, 64.  
 477. *S. robusta* E. var. *splendida* (E.) van Heurck. Sample 48.  
 478. *S. tenera* Greg. Samples 1, 7, 13, 14, 20, 23, 29, 45, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58.  
 479. *S. tenera* forma *minor* Chy. Sample 64.



## TRIBUS: EUTHALLOPHYTA

Class: Chlorophyceae.

Order: Protococcales.

Fam.: Hydrodictyaceae.

**Pediastrum** Meyen.

480. *P. boryanum* (Turpin) Menegh. var. *granulatum* (Kütz.) Al Braun. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 101, fig. 61e.) This agrees in shape and size with var. *granulatum* Al Braun, but no granules were perceptible. (Tab. 33, fig. 4.) Sample 20.
481. *P. boryanum* var. *longicorne* Reinsch. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 101, fig. 61d.) Sample 20.
482. *P. boryanum* var. *minor* var. nova, *P. boryano* var. *forcipato* Racib. affinis, sed membrana cellulae neque granulata neque punctata facile distinguenda.  
Near var. *forcipatum* Racib. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 101, fig. 61f); but the membrane is not granular or punctate. Colonies with 16–31 cells, margin-cells 6–8  $\mu$  in diameter; cells 8–11  $\mu$  long and 5–6  $\mu$  broad. (Tab. 33, fig. 5.) Samples 18, 20.
483. *P. duplex* Meyen var. *reticulatum* Lagerheim. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 95, fig. 57h.) Sample 47.
484. *P. duplex* var. *reticulatum* forma *cohaerens* Bohlin. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 95, fig. 57f.) (Tab. 33, figs. 1–3.) Sample 74.
485. *P. tetras* (Ehrenb.) Ralfs forma *evoluta* West. Samples 47, 48.
486. *P. tetras* var. *excisum* Rabenh. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 104, fig. 64b.) (Tab. 33, fig. 6.)

Fam.: Coelastraceae.

**Scenedesmus** Meyen

487. *Sc. bijugatus* (Turpin) Kütz. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 167.) Samples 19, 23, 48.
488. *Sc. quadricauda* (Turpin) Bréb. (Pascher Süßwasser-Flora, Heft 5, 1915, p. 165, fig. 223.) Samples 12, 20, 23, 35, 47, 48.

Order: Ulotrichales.

Fam.: Oedogoniaceae.

**Oedogonium** Link.

489. *Oe. boyanum* spec. nova, *Oe. crassum* Wittr. sec. Hirn affinis, sed plantae bisexuales, antheridia 3–16-cellulata, oogonia et oosporae latiores sunt.

This species is near *Oe. crassum* Wittr. sec. Hirn. (Pascher Süßwasserflora, Heft 6, 1914, p. 200, fig. 286); but the plants are monoecious, the antheridia have 3–16 cells and the oogonia and oospores are broader. Oogonia solitary, elliptical, with a pore in the upper part, 79–82  $\mu$  broad and 112–130  $\mu$  long. Oospores elliptical, not filling the oogonium, membrane smooth and thick, 74  $\mu$  broad and 91  $\mu$  long. Vegetative cells 52–54  $\mu$  broad and 96–192  $\mu$  long. Antheridium cells 44–48  $\mu$  broad and 6–12  $\mu$  long. (Tab. 34, figs. 9, 10.) Sample 73.

490. *Oe. mattiei* spec. nova, *Oe. zig-zag* Cleve sec. Hirn affinis, sed antheridiis 1-3-cellulatis, cellulis sterilibus latoribus, oogoniis brevioribus, zygotis globosis et oogonium haud complementibus, cellulis antheridii latoribus brevioribusque valde differt.

Near *Oe. zig-zag* Cleve sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 209, fig. 304); but differs in that the oospore does not fill the oogonium, and in having broader vegetative cells, shorter oogonia, spherical oospores, and shorter, broader, 1-celled to 3-celled antheridia. Monoecious; oogonium solitary, more or less spherical, with a pore in the upper part, 44-50  $\mu$  broad and 43-52  $\mu$  long. Oospore membrane smooth and thick, 42  $\mu$  in diameter. Vegetative cells 28-30  $\mu$  broad and 40-72  $\mu$  long. Antheridium cells 26-28  $\mu$  broad and 6-8  $\mu$  long. (Tab. 34, fig. 8.) Sample 73.

491. *Oe. mesianum* spec. nova, *Oe. varians* Wittr. et Lund. sec. Hirn affinis, sed ternis vel quaternis antheridiorum cellulis, sterilibus cellulis paulo latoribus et zygotis multo minoribus facile distinguenda.

This species closely resembles *Oe. varians* Wittr. & Lund. sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 206, fig. 298); but the antheridia consist of 3-4 cells, the vegetative cells are slightly broader and the oospores are considerably smaller. Monoecious; oogonia solitary, subovate, with a pore in the upper part, oogonia 36  $\mu$  broad and 38  $\mu$  long. Oospores spherical, not filling the oogonia, membrane smooth and fairly thick, 27  $\mu$  in diameter. Vegetative cells 16-20  $\mu$  broad and 44-80  $\mu$  long. Antheridium cells 15  $\mu$  broad and 3-8  $\mu$  long. (Tab. 34, fig. 5.) Sample 20.

Named after the late Prof. Dr. M. G. Mes, formerly Head of the Department of Plant Physiology and Biochemistry, University of Pretoria.

492. *Oe. pseudofragile* spec. nova, ex affinitate *Oe. fragile* Wittr. sec. Hirn. Differt tamen eo quod antheridiis ternae, quaternae vel quinae sunt cellulae, oogonia et oosporae minora sunt et antheridii cellulae breviores.

Near *Oe. fragile* Wittr. sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 207, fig. 302); but the antheridia consist of 3-5 cells, the oogonia and oospores are smaller and the antheridium cells are shorter. Monoecious; oogonia solitary, more or less spherical, with a pore in the upper part, 36-38  $\mu$  broad and 32-36  $\mu$ . Oospores not filling the oogonia, more or less spherical, membrane smooth and fairly thick, 32  $\mu$  broad and 30-32  $\mu$  long. Vegetative cells 12-20  $\mu$  broad and 44-80  $\mu$  long. Antheridium cells 12-16  $\mu$  broad and 4-6  $\mu$  long. (Tab. 34, figs. 1-4.) Sample 20.

493. *Oe. subintermedium* spec. nova, affinis *Oe. intermedio* Wittr. sec. Hirn, sed differt quod oogonium in parte superiore angustatum, cellulae steriles paulo latiores, cellulae antheridii paulo et latiores et longiores sunt quam in *Oe. intermedio*.

This is near *Oe. intermedium* Wittr. sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 207, fig. 301); but the upper part of the oogonium is attenuated, the vegetative and antheridium cells are slightly broader and the antheridium cells are slightly longer. Monoecious; oogonia solitary, more or less spherical, with a pore in the upper part, 34  $\mu$  broad and 33  $\mu$  long. Oospore more or less spherical, not filling the oogonium, membrane smooth, 30  $\mu$  broad and 28  $\mu$  long. Vegetative cells 20  $\mu$  broad and 60-80  $\mu$  long. Antheridia 2-celled, 19  $\mu$  broad and 10-12  $\mu$  long. (Tab. 34, fig. 6.) Sample 73.

494. *Oe. subvaucherii* spec. nova, *Oe. vaucherio* A. Braun sec. Hirn affinis. sed oogoniis globosis differt.

This differs from *Oe. vaucherii* A. Braun sec. Hirn (Pascher Süßwasserflora, Heft 6, 1914, p. 207, fig. 303) in the oogonia being spherical. Monoecious; oogonium solitary, spherical, with a pore in the upper part, 46  $\mu$  in diameter. Oospore spherical, not filling the oogonium, membrane smooth and thick, 40  $\mu$  in diameter. Vegetative cells 22  $\mu$  broad and 60-80  $\mu$  long. Antheridia 2-4-celled, 19  $\mu$  broad and 6-8  $\mu$  long. (Tab. 34, fig. 7.) Sample 73.

### III.—VEGETATIVE REPRODUCTION IN DESMIDS

In Desmids vegetative reproduction takes place by cell division. In the genera possessing a median constriction the two semicells move apart during the elongation of the isthmus which is accompanied or followed by nuclear division. Normally the next step is the formation of a cylindrical girdle band within the wall in the median region of the elongated isthmus. In exceptional cases the girdle band is not formed during every cell division; in some species the girdle band is consistently absent. From this girdle band a plate-like projection grows inwards and eventually becomes the cross-partition. Simultaneously the elongated isthmus-halves begin to swell and develop into new semicells. During this process of swelling the chloroplasts of the parent semicells elongate, divide and take up their position in the newly formed semicells. Finally, the cross-partition splits and the newly formed individuals move apart.

Cell division does not always take place in the normal manner in vitro: it was observed that an individual in which one of the semicells had not reached full maturity was capable of dividing again, so that the daughter individuals differed markedly in shape and size from the normal type. (See Tab. 13, fig. 3; Tab. 21, figs. 1, 4; Tab. 22, figs. 5, 6; Tab. 23, fig. 1.)

During August, 1955, cell division was studied in two species of *Micrasterias*. It was observed that the chloroplasts of individuals about to divide were a deeper green colour than those of resting individuals.

The rate and manner of cell division in *Micrasterias crux-melitensis* (Ehrenb.) Hass. are illustrated in Tab. 35, figs. A–P. Similar observations on *Micrasterias denticulata* Bréb. are presented in Tab. 36, figs. A–G and Tab. 37, figs. H–K.

Cell division usually begins during the afternoon. The first divisional stages are reached fairly rapidly; but it may take up to several days before the new semicells reach their mature size, normal shape and effiguration.

Not infrequently however, patterns deviating from the normal are met with. For instance, the cross septum may not be completed, and the swelling isthmus develops curiously shaped monstrosities between the two adjacent parent semicells.

Rosenberg (1940) studied the effect of various sets of conditions on zygosporic formation in desmids. He worked mainly with *Micrasterias americana* (Ehrenb.) Ralfs. He found that a low rate of division was obtained by growing this species in Benecke's nutrient solution (250 p.p.m.) in the dark at a low temperature of 8°C. After 10 days, he examined the cultures and found that about 10 per cent of the cells were abnormally large and contained an additional section between the two halves which normally join at the isthmus. When these giant cells were isolated and placed under conditions favouring rapid division, each cell divided at both isthmuses simultaneously, giving rise to one giant cell and two normal cells. The results of several series of experiments showed that giant cell formation takes place when conditions are unfavourable for cell division, for instance during the winter.

In the material collected in the districts of Warmbaths, Nylstroom and Naboomspruit giant cells were observed in: *Euastrum insulare* (Witt.) Roy (Tab. 9, fig. 12); *Micrasterias crux-melitensis* (Ehrenb.) Hass. (Tab. 21, fig. 4; Tab. 22, figs. 1–3); *Cosmarium sexnotatum* Gutw. var. *simplex* Claassen (Tab. 24, fig. 9); *C. waterbergense* Claassen (Tab. 26, figs. 4–7) and *Staurostrum dilatatum* Ehrenb. (Tab. 30, fig. 6). The material of *M. crux-melitensis* was collected during August, 1955 and that of the other four species during April, 1954.

As only mature giant cells were observed, and not their actual formation, it was not possible to determine whether those in *M. crux-melitensis* were the result of a very low division rate or not. It should be mentioned that numerous other variations in this species were observed to arise during very rapid division. The material containing giant cells of the other four species was fixed at the time of collecting.



Numerous variations were observed among the specimens of *M. crux-melitensis* (Ehrenb.) Hass. The normal type is illustrated in Tab. 18, figs. 1, 2 and the following figures depict the majority of the variations: Tab. 18, figs. 3-14; Tab. 19, figs. 1-11; Tab. 20, figs. 1-6; Tab. 21, figs. 1-4; Tab. 22, figs. 1-6; Tab. 23, fig. 1.

G. S. West (1899) in discussing variation in the Desmidiaceae, states:

"The ordinary method of increase in this family (Desmidiaceae) of unicellular plants is by division of the mother-cell into two exactly similar daughter-cells, each constituted of one of the half-cells of the mother and a newly developed half. The latter is sometimes markedly different from the parent half, but in cases where this difference is extreme the new halves of the next division generally conform to the original type, though more rarely this may not occur for several generations.

The great diversity of form and wonderfully varied character of these plants are to be associated with their confinement to small ponds or the quiet margins of lakes, &c., localities suitable for their existence in large numbers. In these restricted areas the unceasing effect of the struggle for existence will result in a gradually increasing diversity of form, and this is to be correlated with the immense numbers of individuals that are sometimes found in these situations.

As regards the conditions favourable to variation among the members of this group of plants, it may be said that the occurrence in large quantity of a particular species is most conducive to the production of deviations from the normal form. It may happen that in some localised spot an immense quantity of some particular species is occasionally produced by very rapid division, and in such a case some variation is always met with".

The foregoing facts were found to be applicable to fresh material of *Microsterias crux-melitensis* (Ehrenb.) Hass. kept in glass containers and studied from 12/7/55 onwards. It was observed in numerous individuals that where there were differences between the new semicells and the parent semicells, the semicells formed during the next division reverted to the original type (Tab. 18, fig. 7; Tab. 19, fig. 7; Tab. 21, figs. 1, 3).

West (1899) also states:

"The most numerous variations are to be found amongst the commoner and more widely distributed species. The majority of these variations appear to affect only the superficial characters—the warts, spines, striations, granules, scrobiculations, &c., on the external or internal surfaces of the cell-wall. Some of them, however, are more important modifications, being changes in the external form of symmetry of the plant; and yet others are variations in the structure and arrangement of the cell-contents.

That variation in a species has a tendency to be reproduced there can be no doubt, especially when the reproduction takes place, as in these plants, by simple cell-division; yet extreme modifications, which are obvious abnormalities, are never (or very rarely) repeated in succeeding generations and may be regarded merely as accidental occurrences in the history of species.

The five statements which follow represent the result of the direct observations on variation in this group of plants, and may, owing to our insufficient knowledge of the question, be subject to further alterations.

1. The structure of the cell-contents is one of the most constant features exhibited by a species; but this fact can be of little classificatory value owing to the very large number of species which possess the same structure and arrangement of the chromatophores.



2. The outward form of the cell, as seen in front view, varies within certain limits, which are usually very small, but which may in exceptional cases be considerable. The form of the vertical view is, as a rule, a more constant feature than the form of the front view.
3. The ornamentation (scrobiculations, granulations, spinulations, &c.) of the cell-wall is relatively constant, being always arranged according to a definite law, which is only transgressed by variations in one or more of the individual component groups which constitute the pattern of arrangement.
4. The prolific growth and rapid division of immense numbers of Desmids have a tendency to produce variations from the typical forms.
5. Changes in the conditions of environment cannot affect the characters of a species unless they act for long periods of time".

Abnormal cell division was also observed in two species of *Cosmarium* viz. Tab. 28, fig. 3 and Tab. 29, fig. 4.

#### IV.—SUMMARY

The freshwater algal flora of the districts of Warmbaths, Nylstroom and Naboomspruit in South Africa has been investigated. A total of 494 species, varieties and forms have been identified. These include 17 Cyanophyceae with seven genera, two Flagellatae with two genera, four Mesotaeniaceae with two genera, 207 Desmidiaceae with 12 genera, 249 Diatomeae with 26 genera and 15 Chlorophyceae with three genera. Thus in the material studied, the Desmidiaceae and Diatomeae are best represented.

Several of the taxa in the present communication are new records for South Africa.

The diatom taxa have been studied in detail by Dr. B. J. Cholnoky and are only mentioned in the taxonomic part for the sake of completeness as regards the survey of the freshwater algal flora of the region under consideration. Of the 245 other taxa, 157 are described as new species, varieties or forms, as indicated in Table I.

TABLE I.—*The Numbers of Species, Subspecies, Varieties and Forms belonging to the Different Groups*

	Total Spp.	New Spp.	Total Subspp.	Total Varieties	New Varieties	Total Forms	New Forms
Cyanophyceae.....	17	10	—	—	—	—	—
Flagellatae.....	1	—	—	1	1	—	—
Mesotaeniaceae.....	3	2	—	1	—	—	—
Desmidiaceae.....	100	46	1	95	84	11	7
Chlorophyceae.....	8	6	—	5	1	2	—
TOTALS.....	129	64	1	102	86	13	7

From the investigation of this relatively small area in South Africa, it is clear that—

- (1) new taxa are abundant in this area;
- (2) additional taxa from this area await description since several of these were in a condition that did not permit identification;
- (3) further investigation is of the utmost importance if a relatively complete survey of the freshwater microflora of this area is aimed at. In this respect a closer study of the Cyanophyceae, Flagellatae, Chlorophyceae, Zygnemales and the smaller forms of the Desmidiaceae should be undertaken.

## ACKNOWLEDGEMENTS

It is my pleasant duty to offer my cordial thanks to the following persons and institutions to whom I am indebted for help and advice during my studies:—

The Council for Scientific and Industrial Research, Pretoria, for liberal financial assistance during the course of these studies;

The Librarian, Division of Botany and Plant Pathology, Department of Agriculture, Pretoria, for the generous loan of literature;

Prof. Dr. H. G. Schweickerdt, Department of General Botany, University of Pretoria, for his encouragement and guidance throughout this investigation;

Dr. B. J. Cholnoky, C.S.I.R., Pretoria, for collecting samples 47–74 and determining the Diatom taxa;

Dr. W. B. Turrill, Royal Botanic Gardens, Kew, for supplying certain literature on Desmids not available in South Africa;

Prof. Dr. H. G. Schweickerdt, Department of General Botany, and Prof. Dr. H. L. Gonin, Department of Latin, University of Pretoria, for their assistance with the Latin diagnoses of new taxa.

A word of special thanks is due in memory of my parents for their encouragement and financial assistance throughout this study.

The author is most grateful to these persons and institutions for their generous help, without which this study would not have been possible.

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\* This area is situated in N.W. Transvaal.

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## EXPLANATION OF THE ILLUSTRATIONS.

## FIGURE 1.

Topographical Map of the districts of Warmbaths, Nylstroom and Naboomspruit showing the principal localities where collections were made.

## FIGURE 2.

Localities of collections in the Doornfontein and Leeupoort area.

## FIGURE 3.

Localities of collections in the Moddernek area.

## TABULA 1

Figs.

- 1, 2. *Stigonema pseudominutum* sp. nov.
- 3-7. *Scytonema myochrous* (Dillw.) Ag.

## TABULA 2

Figs.

1. *Nostoc pseudogelatinosum* sp. nov.
  2. *N. nylstromicum* sp. nov.
  3. *Anabaena galpinii* sp. nov.
  4. *A. mesiana* sp. nov.
  5. *A. pseudocatenula* sp. nov.
  6. *Oscillatoria subpristleyi* sp. nov.
  7. *O. nylstromica* sp. nov.
  8. *O. tenuis* Ag.
  9. *O. waterbergensis* sp. nov.
  10. *Lyngbya uliginosa* sp. nov.
- Figs. 3, 4  $\times$  a; 5, 6, 7, 9  $\times$  b; 1, 2, 8, 10  $\times$  c.

## TABULA 3

Figs.

1. *Cylindrocystis barbarica* sp. nov.
  2. *C. caffra* sp. nov.
  3. *Penium margaritaceum* (Ehrenb.) Bréb.
  4. *P. margaritaceum* var. *incognitum* var. nov.
  5. *P. margaritaceum* var. *brevior* var. nov.
  6. *P. barbaricum* sp. nov.
  7. *P. libellula* (Focke) Nordst. var. *schweickerdtii* var. nov.
  8. *P. subcucurbitinum* sp. nov.
  9. *P. curtum* Bréb. var. *waterbergense* var. nov.
  - 10-13. *P. mesianum* sp. nov.
  14. *P. pseudorufescens* sp. nov.
  15. *P. curcurbitinum* Biss. forma *botesii* forma nov.
  - 16, 17. *Penium* species ad *P. cruciferum* (De Bary) Wittr. Fig. 17 = zygospore.
- Figs. 4, 5, 6, 7, 10, 11, 13  $\times$  a; 1, 2, 3, 8, 9, 12, 14, 15, 16, 17  $\times$  b.  
a = 40  $\mu$ ; b = 40  $\mu$ .

## TABULA 4

FIGS.

1. *Closterium pseudolunula* sp. nov.
2. *C. spetsbergense* Borge var. *subafricanum* var. nov.
3. *C. intermedium* Ralfs var. *mesianum* var. nov.
- 4-5. *C. kranskopense* sp. nov.
- 6-7. *C. acerosum* (Schränk) Ehrenb. var. *waterbergense* var. nov.
- 8-11. *C. malinvernianum* De Not.

Figs. 1, 3, 4, 8, 9, 10, 11  $\times$  a; 6  $\times$  b; 5, 7  $\times$  c; 2  $\times$  d.

## TABULA 5

FIGS.

1. *Closterium ralfsii* Bréb. var. *subralfsii* var. nov.
2. *C. ralfsii* var. *glentigianum* var. nov.
3. *C. ralfsii* var. *nodosum* var. nov.
- 4-5. *C. ralfsii* var. *minor* var. nov.
6. *C. truncatum* sp. nov.
7. *C. subsiliqua* sp. nov.
8. *C. pseudoleibleinii* sp. nov.
9. *C. striolatum* Ehrenb. var. *nylstromicum* var. nov.
10. *C. striolatum* var. *subnylstromicum* var. nov.
11. *C. subdecorum* sp. nov.
12. *C. decorum* Bréb. var. *minor* var. nov.
13. *C. boyanum* sp. nov.
14. *C. moniliferum* (Bory) Ehrenb. var. *epithemioides* var. nov.
15. *C. cymbellaeformis* sp. nov.
16. *C. atomicum* sp. nov.
17. *C. sublagense* sp. nov.
18. *C. schweickerdtii* sp. nov.

Figs. 1, 2, 3  $\times$  a; 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 18  $\times$  b; 11, 12, 16, 17  $\times$  c.

## TABULA 6

FIGS.

1. *Closterium kützingii* Bréb. var. *transvaalense* var. nov.
2. *C. warmbadianum* sp. nov.
3. *C. warmbadianum* var. *porulosum* var. nov.
- 4-6. *C. barbaricum* sp. nov.
7. *C. jenneri* Ralfs var. *dubitabilis* var. nov.
8. *C. parvulum* Näg. var. *minor* var. nov.
- 9-10. *C. abruptum* West var. *westiorum* var. nov.
11. *C. peracerosum* Gay var. *elegans* G. S. West.
12. *C. gracile* Bréb. var. *brevius* var. nov.
13. *C. tumidum* Johnson var. *angustum* var. nov.
14. *C. ceratium* Perty var. *angustum* var. nov.
15. *C. tumidum* Johnson.
- 16-18. *C. venus* Kütz. var. *inflatum* var. nov.
19. *C. incurvum* Bréb. var. *elaboratum* var. nov.
20. *C. calosporum* Wittr. var. *minor* var. nov.
21. *C. ehrenbergii* Menegh. var. *minutissimum* var. nov.
22. *C. acutum* (Lyngb.) Bréb. var. *linea* (Perty) W. & G. S. West forma *minor* f. nov.
23. *C. cornu* Ehrenb. var. *minor* var. nov.
24. *C. cornu* var. *angustum* var. nov.

Figs. 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 17, 18, 20, 24  $\times$  a; 2, 3, 12, 15, 16, 19, 21, 22, 23  $\times$  b; 1  $\times$  c.a = 40  $\mu$ ; b = 40  $\mu$ .



## TABULA 7

FIGS.

1. *Pleurotaenium trabecula* (Ehrenb.) Näg. var. *barbaricum* var. nov.
2. *Pl. pseudoehrenbergii* var. nov.
- 3-5. *Pl. trabecula* (Ehrenb.) Näg. var. *angustum* var. nov.
6. *Pl. caffrorum* sp. nov.
- 7-8. *Pl. ehrenbergii* (Bréb.) De Bary var. *waterbergense* var. nov.
9. *Pl. westiorum* sp. nov.
10. *Pl. trabecula* var. *brevis* var. nov.

Figs. 7, 8  $\times$  a; 1, 2, 3, 4, 5, 10  $\times$  b; 9  $\times$  c; 6  $\times$  d.

## TABULA 8

FIGS.

- 1, 2. *Pleurotaenium* species ad *Pl. ovatum* Nordst.
3. *Closterium cynthia* De Not var. *waterbergense* var. nov.
4. *C. caffrorum* sp. nov.
5. *C. insolitum* sp. nov.
6. *Pleurotaenium truncatum* (Bréb.) Näg. var. *mattiei* var. nov.
7. *Pl. trochiscum* W. & G. S. West var. *galpinii* var. nov.

Figs. 1, 2  $\times$  a; 3, 4, 5  $\times$  b; 6, 7  $\times$  c.

## TABULA 9

FIGS.

1. *Euastrum spinulosum* Delp. subsp. *africanum* Nordst.
2. *E. spinulosum* subsp. *africanum* var. *transvaalense* var. nov.
3. *E. divergens* Josh. var. *subbifidum* var. nov.
- 4-5. *E. rostratum* Ralfs subsp. *unbonatum* W. & G. S. West var. *kranskopense* var. nov.
- 6-7. *E. brasiliense* Borge var. *theronii* var. nov.
8. *E. ansatum* Ralfs.
9. *E. dubitabilis* sp. nov.
- 10-12. *E. insulare* (Wittr.) Roy.
- 13-14. *E. cuneatum* Jenner var. *minor* var. nov.
- 15-17. *E. pseudovalidum* sp. nov.
18. *E. elegans* (Bréb.) Kütz. var. *transvaalense* var. nov.
- 19-21. *E. schweickerdii* sp. nov.

Figs. 1, 2, 3, 10, 11, 12, 13, 14  $\times$  a; 4, 5, 6, 7, 8, 9, 15, 16, 17, 18, 19, 20, 21  $\times$  b.

a = 40  $\mu$ ; b = 40  $\mu$ .

Figs. 5, 7, 14, 16, 20 = lateral view of cell and figs. 17, 21 = vertical view of semicell.

## TABULA 10

FIGS.

- 1-4. *Micrasterias apiculata* (Ehrenb.) Menegh.

Figs. 1, 2  $\times$  a; 3, 4  $\times$  b.

## TABULA 11

FIGS.

- 1-4. *Micrasterias denticulata* Bréb. var. *africana* var. nov.

Figs. 1, 2  $\times$  a; 3, 4  $\times$  b.

## TABULA 12

FIGS.

1. *Micrasterias denticulata* Bréb. var. *africana* var. nov.
2. *M. denticulata* var. *subnotata* West forma *cornuta* forma nov.
3. *M. nylstromica* sp. nov.

## TABULA 13

FIGS.

- 1-3. *Micrasterias denticulata* Bréb. var. *subnotata* West forma *cornuta* forma nov.
4. *M. nylstromica* sp. nov.

## TABULA 14

FIGS.

- 1-4. *Micrasterias groenewaldii* sp. nov.
- Fig. 2 = vertical view of semicell.

## TABULA 15

FIGS.

- 1-3. *Micrasterias truncata* (Corda) Bréb.
  - 4, 5. *M. truncata* var. *africana* Fritsch & Rich.
  6. *M. sol* (Ehrenb.) Kütz.
- Figs. 1, 2, 3  $\times$  a; 4, 5, 6  $\times$  b.

## TABULA 16

FIGS.

- 1, 2. *Micrasterias crux-melitensis* (Ehrenb.) Hass. var. *transvaalensis* var. nov.
3. *M. crux-melitensis* var. *evoluta* Turn.
4. *M. americana* (Ehrenb.) Ralfs var. *transvaalensis* var. nov.
- 5-7. *M. deccidentata* (Näg.) Arch.

## TABULA 17

FIGS.

1. *Micrasterias crux-melitensis* (Ehrenb.) Hass. var. *evoluta* Turn.
2. *M. mahabuleshwariensis* Hobson var. *transvaalensis* var. nov.
3. *M. tropica* Nordst. var. *elongatissima* var. nov.
- 4-7. *M. deccidentata* (Näg.) Arch. var. *galpinii* var. nov.
8. *M. truncata* (Corda) Bréb. var. *minor* var. nov.

## TABULA 18

FIGS.

- 1-14. *Micrasterias crux-melitensis* (Ehrenb.) Hass.
- Fig. 2 = vertical view of semicell.

## TABULA 19

FIGS.

- 1-11. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 20

FIGS.

- 1-6. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 21

FIGS.

- 1-4. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 22

FIGS.

- 1-6. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 23

FIGS.

1. *Micrasterias crux-melitensis* (Ehrenb.) Hass.  
2, 3. *M. pinnatifida* (Kütz.) Ralfs var. *transvaalensis* var. nov.

## TABULA 24

FIGS.

- 1-3. *Euastrum divaricatum* Lund. var. *transvaalense* var. nov.  
4-5. *Cosmarium pyramidatum* Bréb. var. *majus* var. nov.  
6. *C. contractum* Kirchn. var. *pseudogartanense* var. nov.  
7. *C. laeve* Rabenh. var. *majus* var. nov.  
8, 9. *C. sexnotatum* Gutw. var. *simplex* var. nov.  
10. *C. quadratum* Ralfs var. *africanum* Fritsch.  
11. *C. decoratum* W. & G. S. West var. *waterbergense* var. nov.  
12. *C. nanum* sp. nov.  
13. *C. hanumeri* Reinsch var. *minor* var. nov.  
14, 15. *C. impressulum* Elfv.

Figs. 14 × a; 1-13, 15 × b.

Fig. 2 = lateral view and fig. 3 = vertical view of cell.

a = 40 μ; b = 40 μ.

## TABULA 25

FIGS.

- 1, 2. *Cosmarium pseudotaxichondrum* Nordst. var. *atomicum* var. nov.  
3. *C. orthostichum* Lund. var. *pseudopumilum* var. nov.  
4-6. *C. pseudoprotractum* sp. nov.  
7, 8. *C. cafferorum* sp. nov.  
9. *C. sexangulare* Lund.  
10. *C. trachyleurum* Lund. var. *subspinosum* sp. nov.  
11. *C. transvaalense* sp. nov.  
12-14. *C. subcostatum* Nordst. var. *warmbadianum* var. nov.  
15, 16. *C. debaryi* Arch. var. *minor* var. nov.  
17, 18. *C. granatum* Bréb. var. *africanum* Fritsch.

Figs. 1, 2, 3, 9, 11, 18 × a; 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17 × b.

a = 40 μ; b = 40 μ.

Figs. 2, 6, 14, 16 = vertical view and fig. 5 = lateral view of cells.

## TABULA 26

FIGS.

- 1-7. *Cosmarium waterbergense* sp. nov.  
8. *C. orthostichum* Lund. var. *transvaalense* var. nov.  
9, 10. *C. speciosum* Lund. var. *simplex* Nordst. forma *africanum* forma nov.  
11, 12. *C. tetragonum* (Näg.) Arch. var. *transvaalense* var. nov.  
13. *C. nylstromicum* sp. nov.  
14, 15. *C. subconnatum* sp. nov.  
16. *Cosmarium barbaricum* sp. nov.

Figs. 8, 14, 15 × a; 1-7, 9-13, 16 × b.

Fig. 15 = lateral view of cell.

## TABULA 27

FIGS.

- 1, 2. *Cosmarium binum* Nordst.
- 3, 4. *C. botesii* sp. nov.
5. *C. maximum* (Börg.) W. & G. S. West var. *minor* West.
6. *C. trachypleurum* Lund. var. *pseudonatalensis* var. nov. forma *irregulare* f. nov.
7. *C. trachypleurum* var. *pseudonatalensis* var. nov.
8. *C. connatum* Bréb. var. *subellipticum* var. nov.
9. *C. subtumidum* Nordst. var. *theronii* var. nov.
10. *C. pyramidatum* Bréb. var. *elongatum* var. nov.

Figs. 1, 2, 4, 6  $\times$  a; 3, 5, 7-10  $\times$  b.

Fig. 2 = vertical view of semicell.

## TABULA 28

FIGS.

- 1-3. *Cosmarium obsoletum* (Hantzsch) Reinsch var. *transvaalense* var. nov.
4. *C. pachydermum* Lund. var. *waterbergense* var. nov.
- 5, 6. *C. reniforme* (Ralfs) Arch.
- 7-10. *Xanthidium cristatum* Bréb. var. *transvaalense* var. nov.

Figs. 1, 5, 6, 9, 10  $\times$  a; 2, 3, 4, 7, 8  $\times$  b.

Fig. 10 = vertical view of semicell.

## TABULA 29

FIGS.

1. *Euastrum galpinii* sp. nov.
2. *E. spinulosum* Delp. subsp. *africanum* Nordst.
3. *E. divergens* Josh. var. *galpinii* var. nov.
4. *Cosmarium granatum* Bréb. var. *africanum* Fritsch.
- 5, 6. *C. galpinii* sp. nov.
- 7, 8. *C. schweickerdtii* sp. nov.
- 9, 10. *C. pseudamoenum* Wille.
11. *C. decoratum* W. & G. S. West var. *galpinii* var. nov.
12. *Xanthidium cristatum* Bréb. var. *delpontei* Roy & Biss. forma *laevis* forma nov.
- 13, 14. *Staurostrum setigerum* Cleve var. *pectinatum* W. & G. S. West forma *australe* forma nov.
- 15-17. *St. galpinii* sp. nov.
18. *St. quadrangulare* Bréb. var. *subarmatum* var. nov.
- 19, 20. *St. brevispinum* Bréb. var. *inasoganum* var. nov.

Figs. 6, 14, 15, 20 = vertical view of semicells.

## TABULA 30

FIGS.

- 1-6. *Staurostrum dilatatum* Ehrenb.
- 7-9. *St. caffrorum* sp. nov.
- 10, 11. *St. barbaricum* sp. nov.
- 12, 13. *St. xiphidiophorum* Wolle var. *westiorum* var. nov.
- 14, 15. *St. orbiculare* Ralfs var. *ralfsii* W. & G. S. West.
- 16-18. *St. subtrifurcatum* West forma *major* W. & G. S. West.

Figs. 16  $\times$  a; 14, 15, 17, 18  $\times$  b; 1-13  $\times$  c.

Figs. 3, 4, 8, 11, 12, 14, 18 = vertical view of semicells.



## TABULA 31

FIGS.

- 1, 2. *Staurostrum subgeminatum* W. & G. S. West var. *mattiei* var. nov.
- 3, 4. *St. mesianum* sp. nov.
- 5, 6. *St. orbiculare* Ralfs var. *waterbergense* var. nov.
- 7, 8. *St. dickiei* Ralfs.
- 9, 10. *St. pseudogeminatum* sp. nov.
- 11–13. *St. pseudogeminatum* var. *warmbadianum* var. nov.
- 14–16. *St. dilatatum* Ehrenb.
- 17, 18. *St. trihedrale* Wolle var. *australe* var. nov.
- 19, 20. *St. teliferum* Ralfs var. *transvaalense* var. nov.
- 21, 22. *St. crenatum* var. nov.
- 23, 24. *St. connatum* Roy & Biss. var. *warmbadianum* var. nov.
- 25–27. *St. mattiei* sp. nov.
- 28, 29. *St. pygmaeum* Bréb. var. *botesii* var. nov.

Figs. 2, 4, 5, 7, 10, 11, 13, 15, 16, 17, 20, 22, 24, 26, 29 = vertical view of semicells.

## TABULA 32

FIGS.

- 1, 2. *Staurostrum gemelliparum* Nordst. var. *africanum* var. nov.
- 3–6. *St. furcatum* (Ehrenb.) Bréb.
7. *St. excavatum* W. & G. S. West.
8. *St. leptocladum* Nordst. var. *cornutum* Wille.
9. *Sphaerosina aubertianum* W. West.
10. *Onychonema* species ad. *On. laeve* Nordst. var. *micracanthum* Nordst.
11. *Euglena spirogyra* Ehrenb. var. *major* var. nov.

Figs. 2, 4, 5 = vertical view of cells.

## TABULA 33

FIGS.

- 1–3. *Pediastrum duplex* Meyen var. *reticulatum* Lagerh. forma *cohaerens* Bohlin.
4. *P. boryanum* (Turpin) Menegh. var. *granulatum* (Kütz.) A. Br.
5. *P. boryanum* var. *minor* var. nov.
6. *P. tetras* (Ehrenb.) Ralfs var. *excisum* Rabenh.

Figs. 1, 4, 5, 6  $\times$  a; 2, 3  $\times$  b.

## TABULA 34

FIGS.

- 1–4. *Oedogonium pseudofragile* sp. nov.
5. *Oe. mesianum* sp. nov.
6. *Oe. subintermedium* sp. nov.
7. *Oe. subvaucherii* sp. nov.
8. *Oe. mattiei* sp. nov.
- 9, 10. *Oe. boyanum* sp. nov.

## TABULA 35

FIGS.

- a–p. *Micrasterias crux-melitensis* (Ehrenb.) Hass.

## TABULA 36

FIGS.

- A–G. *Micrasterias denticulata* Bréb.

## TABULA 37

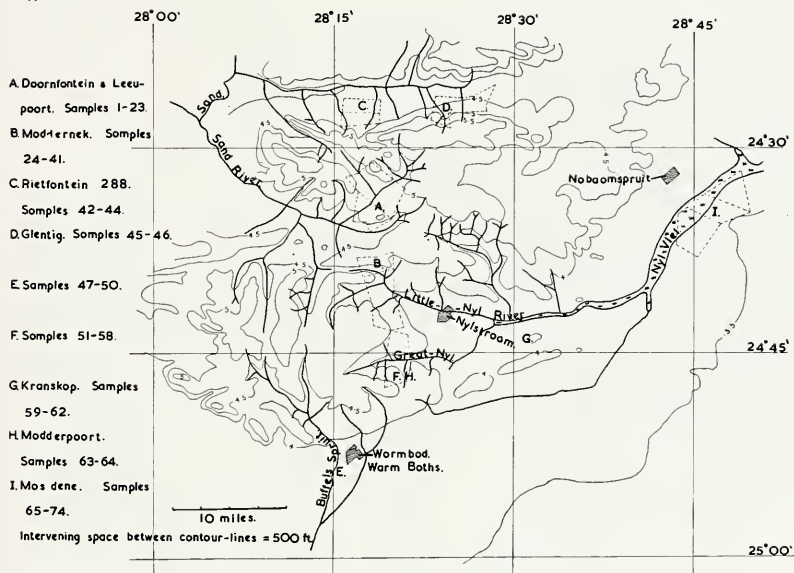
FIGS.

- H–K. *Micrasterias denticulata* Bréb.

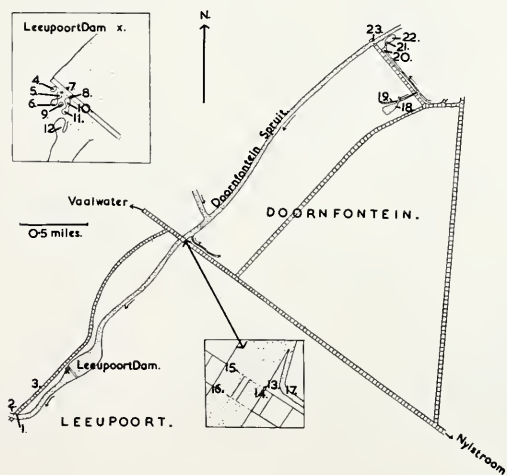


## TOPOGRAPHICAL MAP.

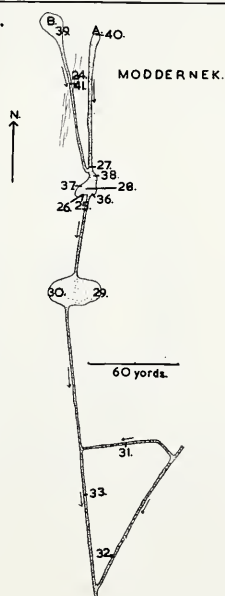
I.



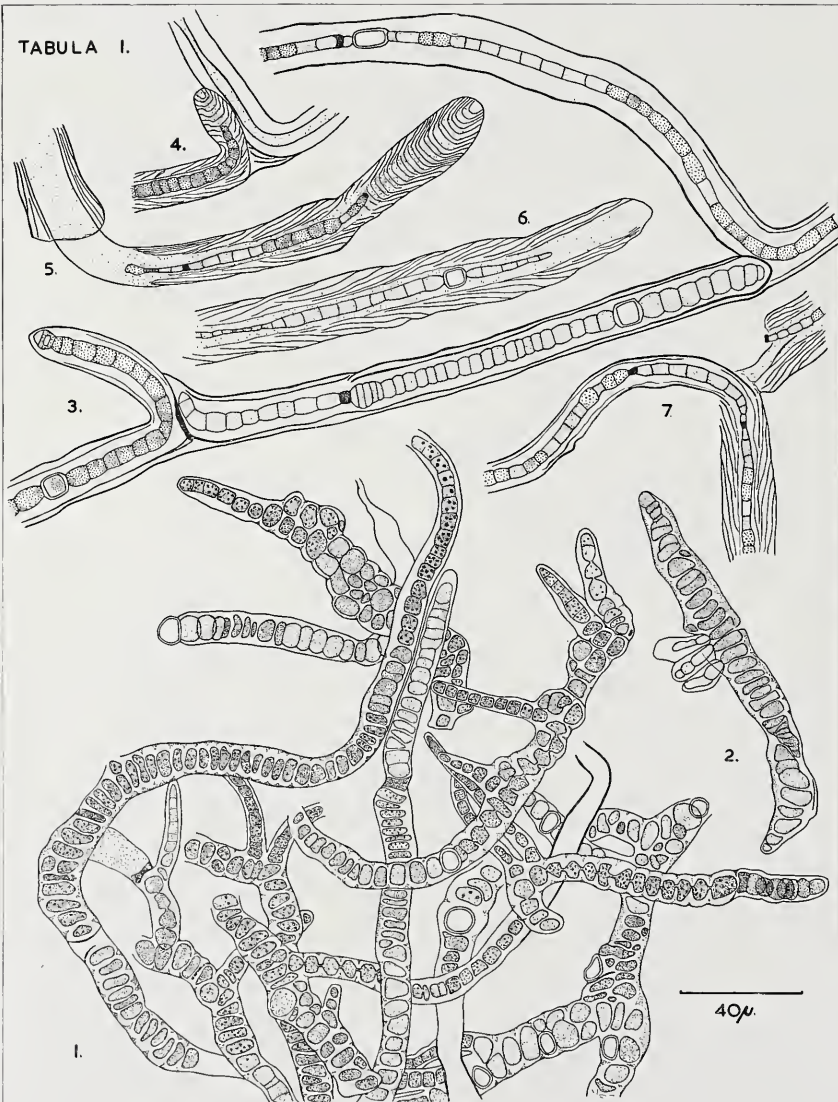
2.



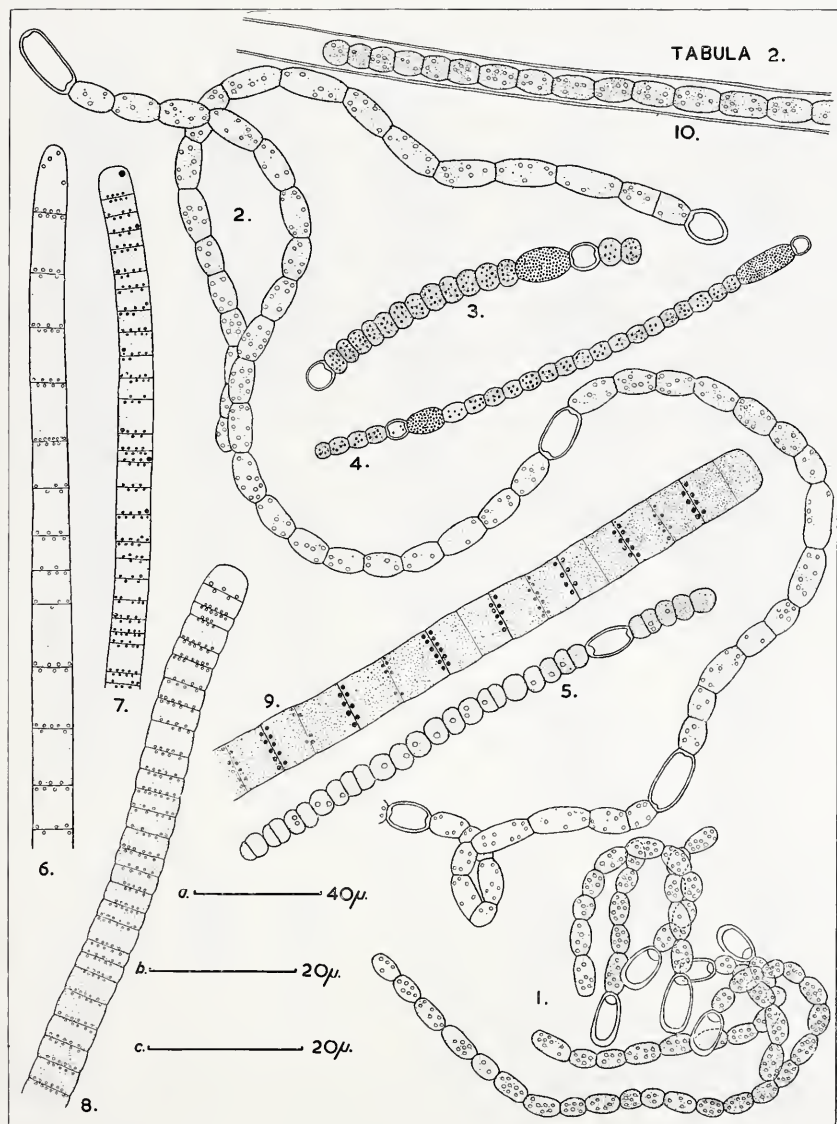
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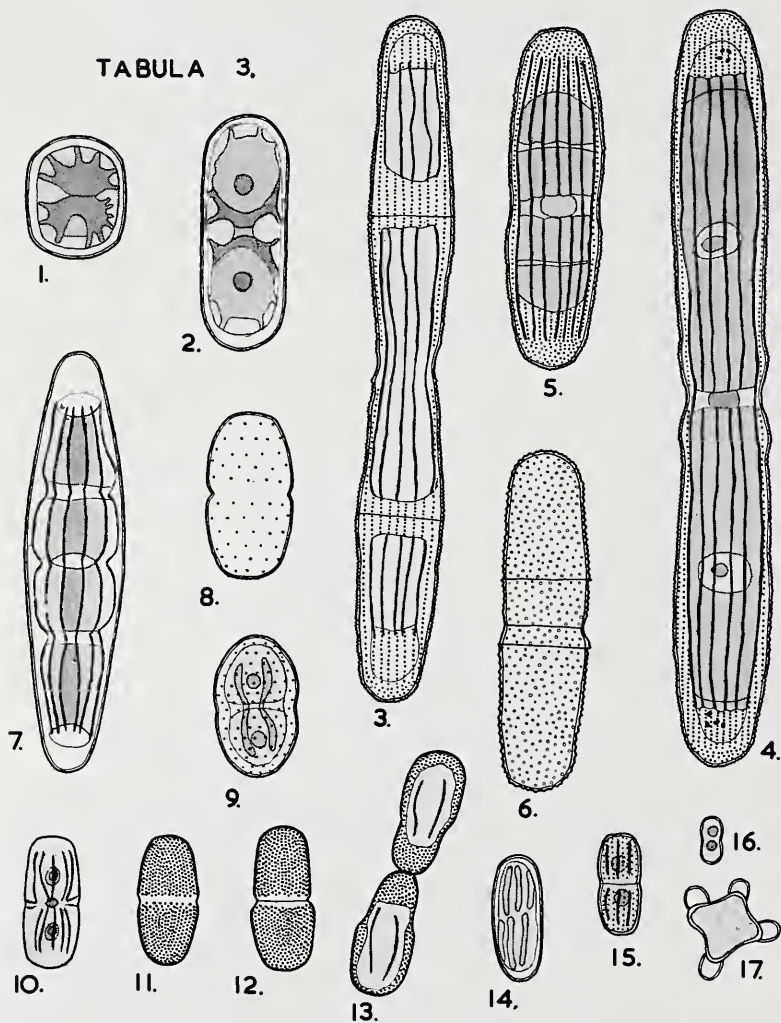
TABULA I.



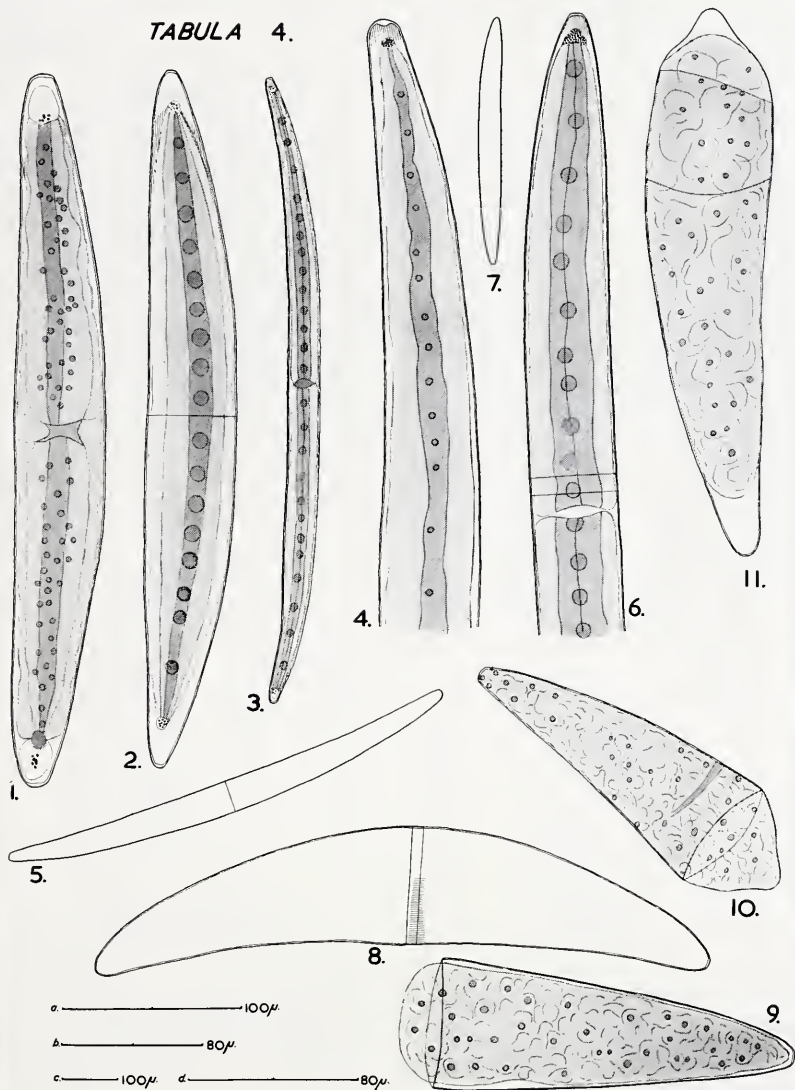




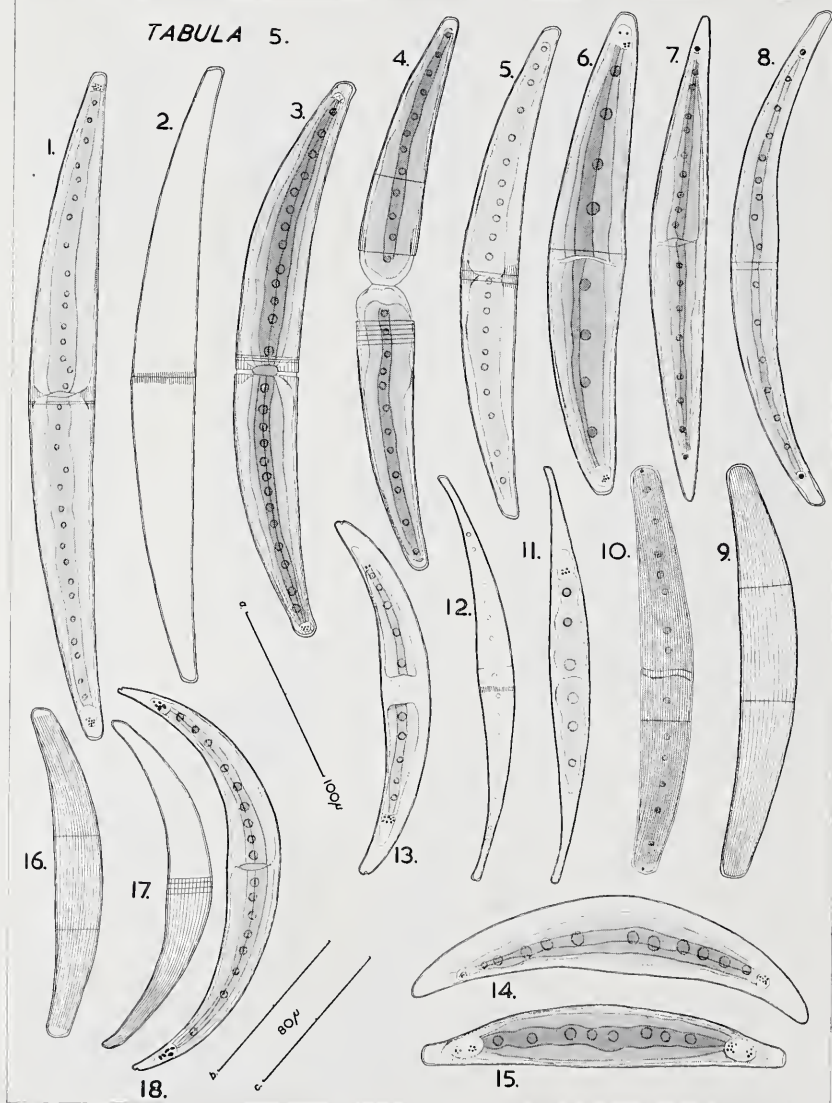
TABULA 3.



TABULA 4.

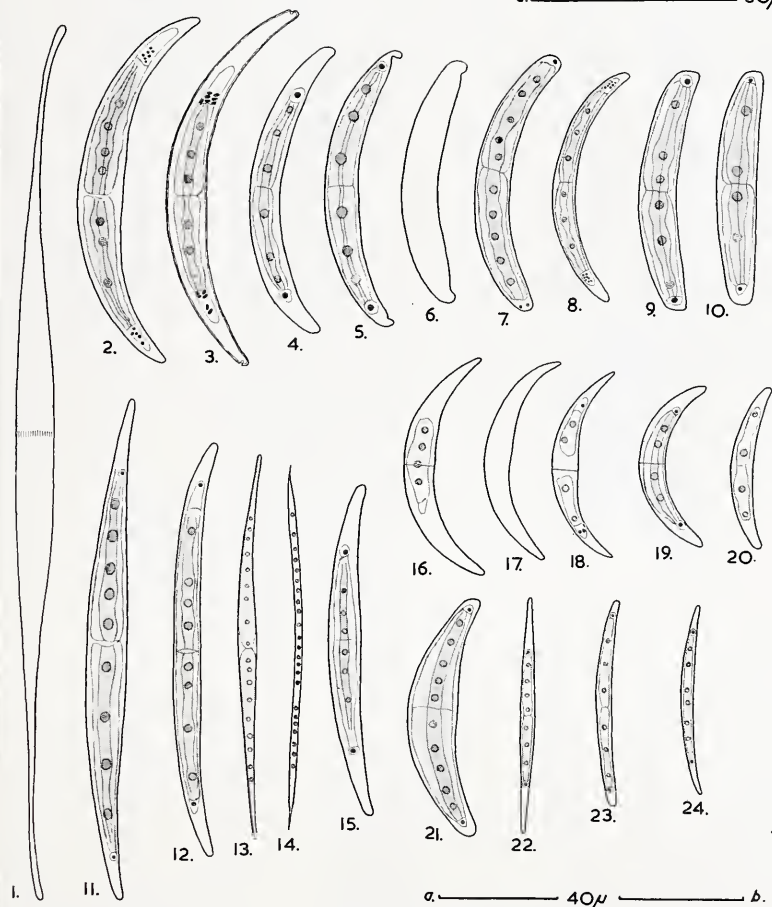


TABULA 5.

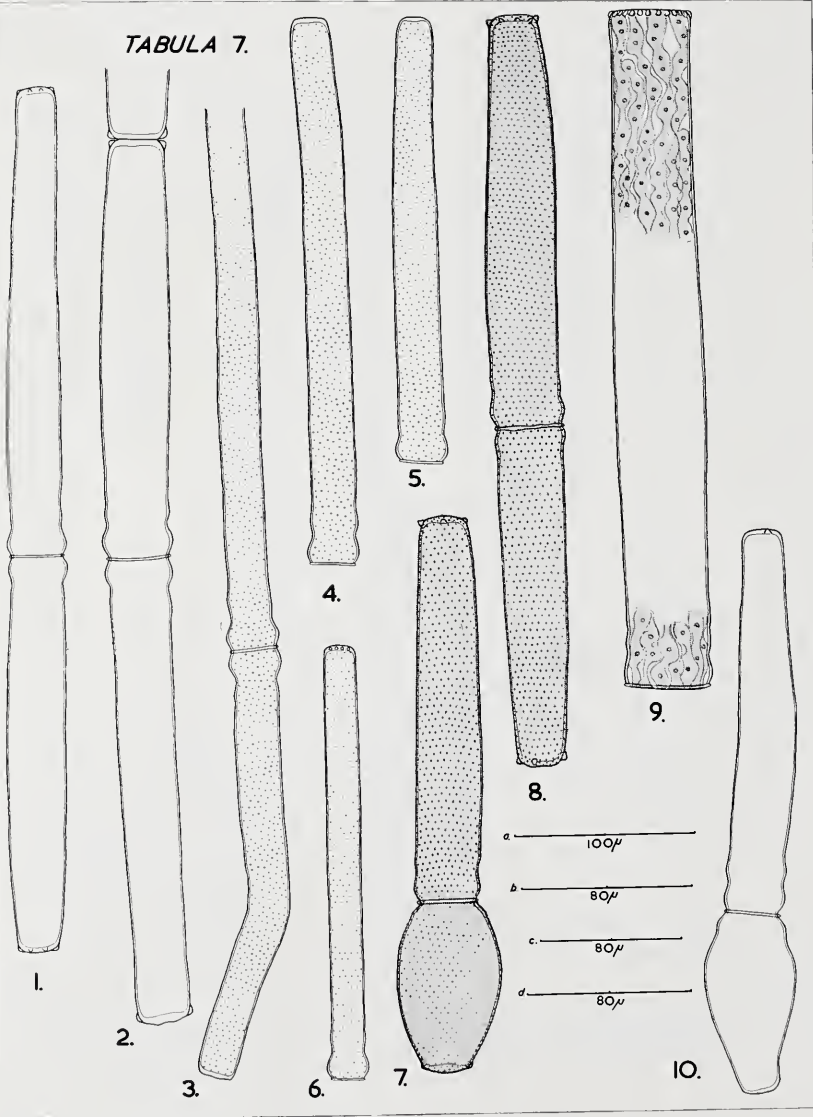




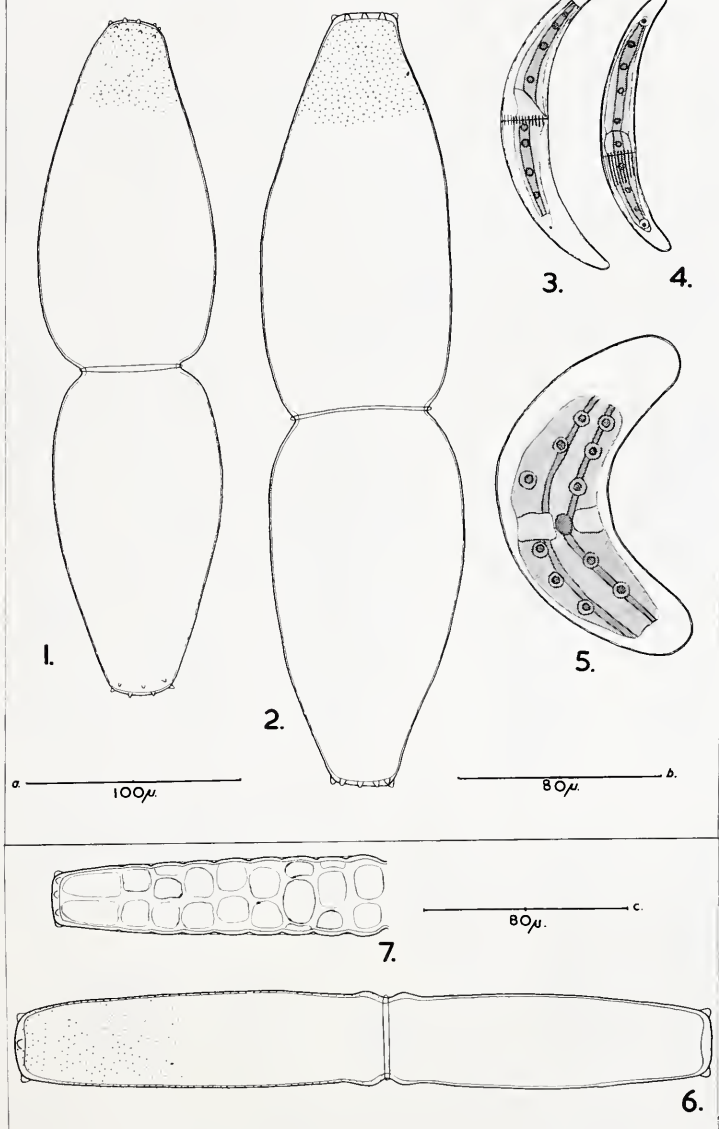
TABULA 6.

c. ————— 80 $\mu$ .

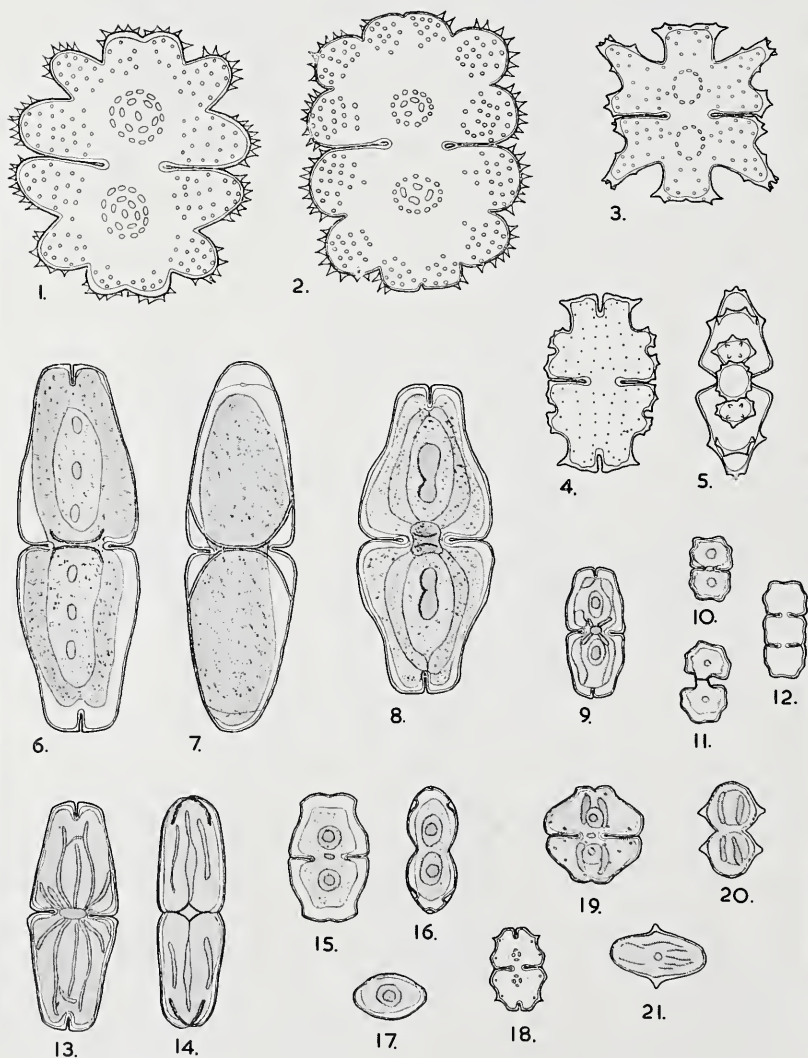
TABULA 7.



## TABULA 8.



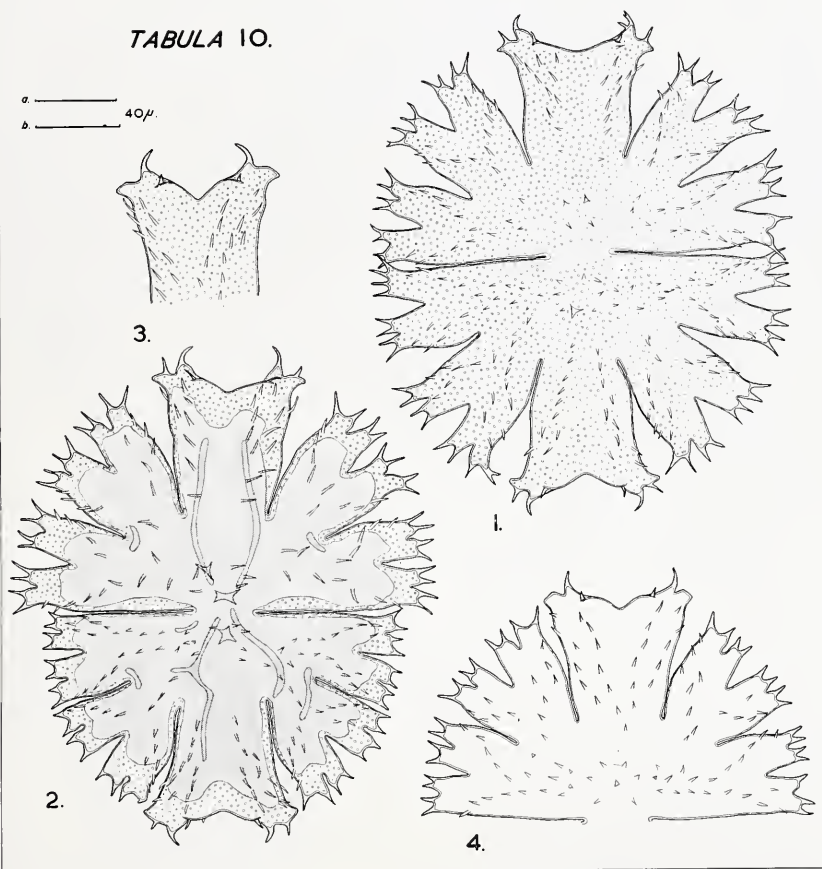
TABULA 9.

a. ————— 40 $\mu$ . ————— b.



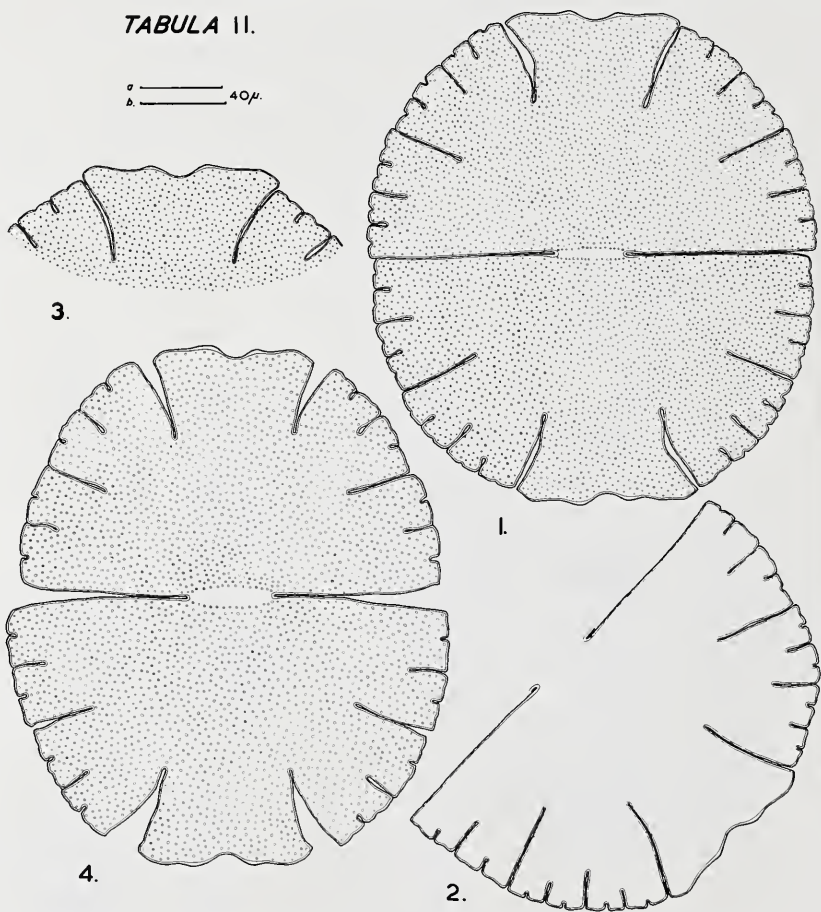
TABULA 10.

a. ————  
b. ———— 40 $\mu$ .

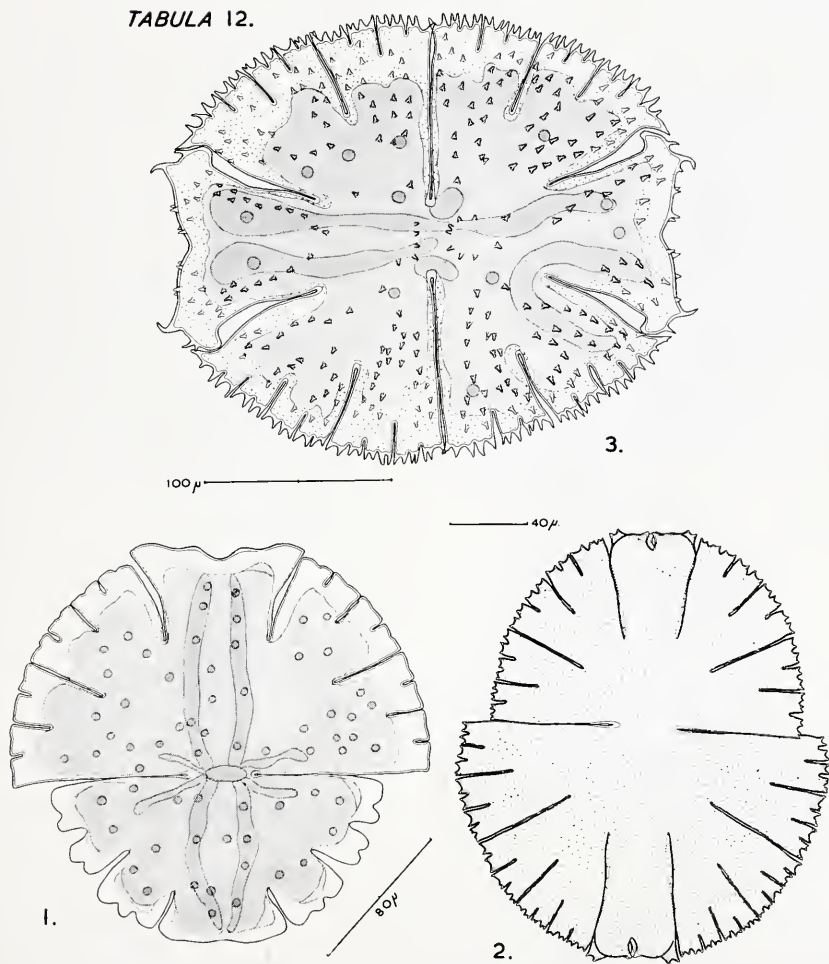


TABULA II.

$\sigma$  \_\_\_\_\_  
b. \_\_\_\_\_ 40 $\mu$ .

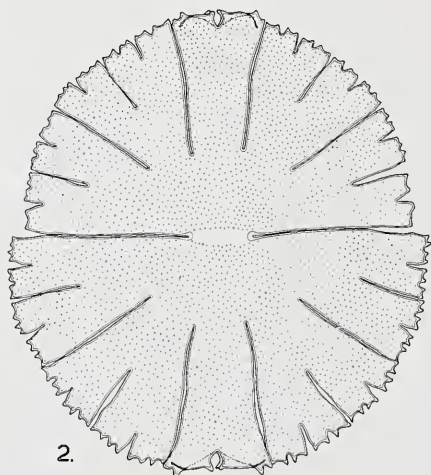
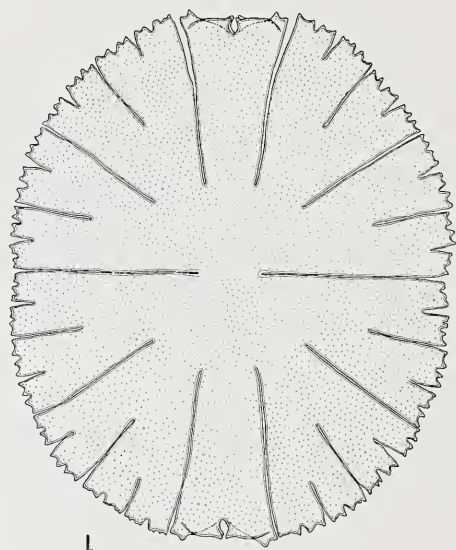


TABULA 12.



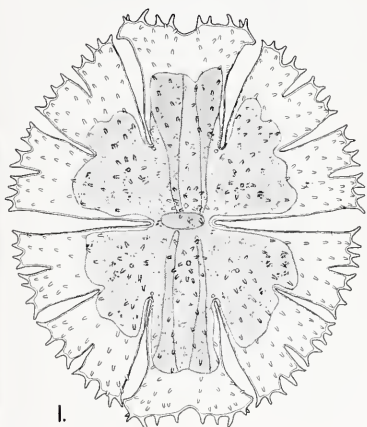
TABULA 13.

—— 40 $\mu$ .

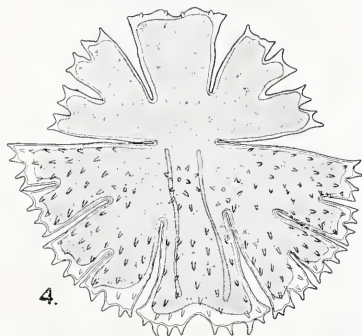
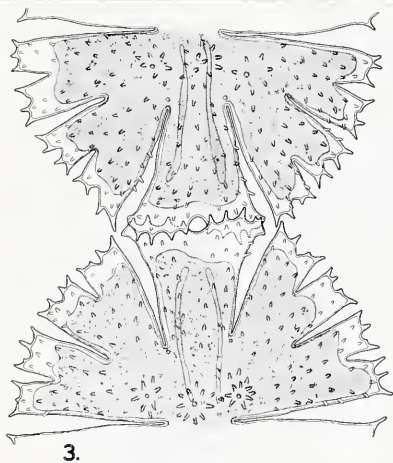




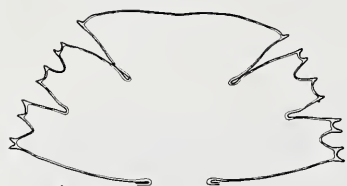
TABULA 14.



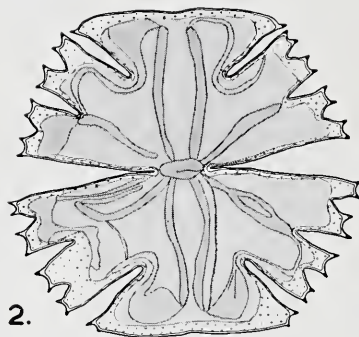
— 40  $\mu$ .



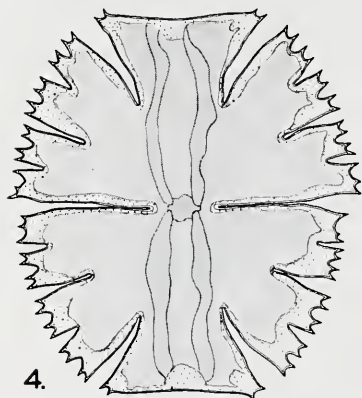
TABULA 15.



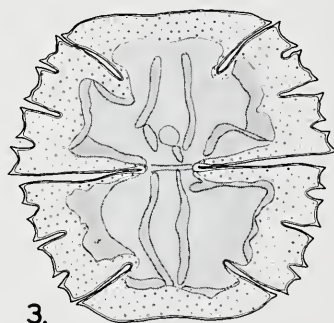
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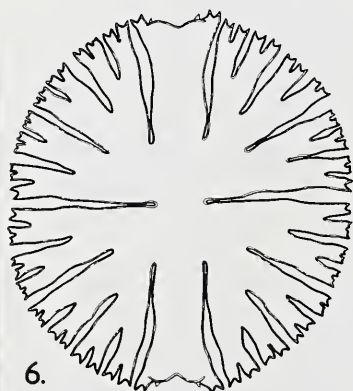
2.



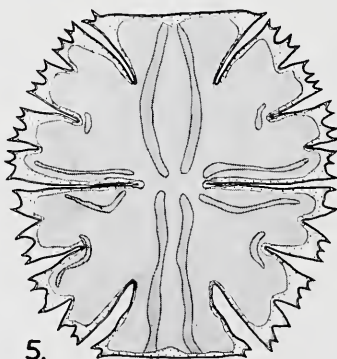
4.



3.



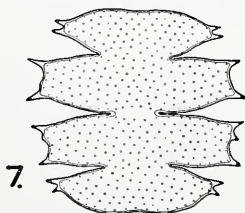
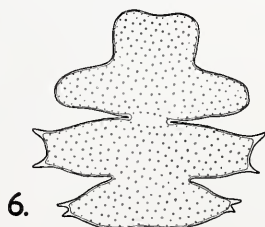
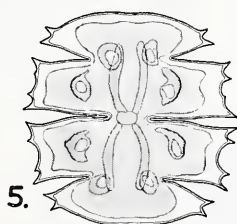
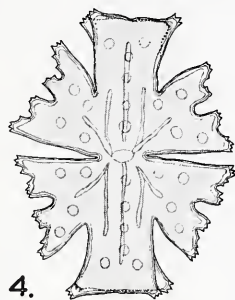
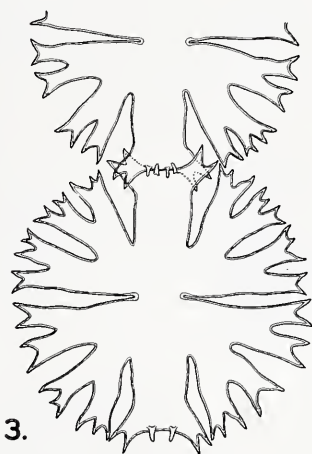
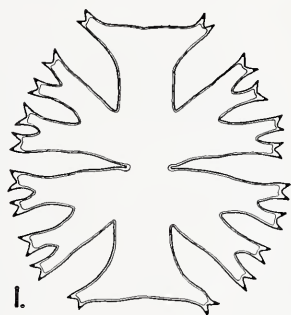
6.



5.

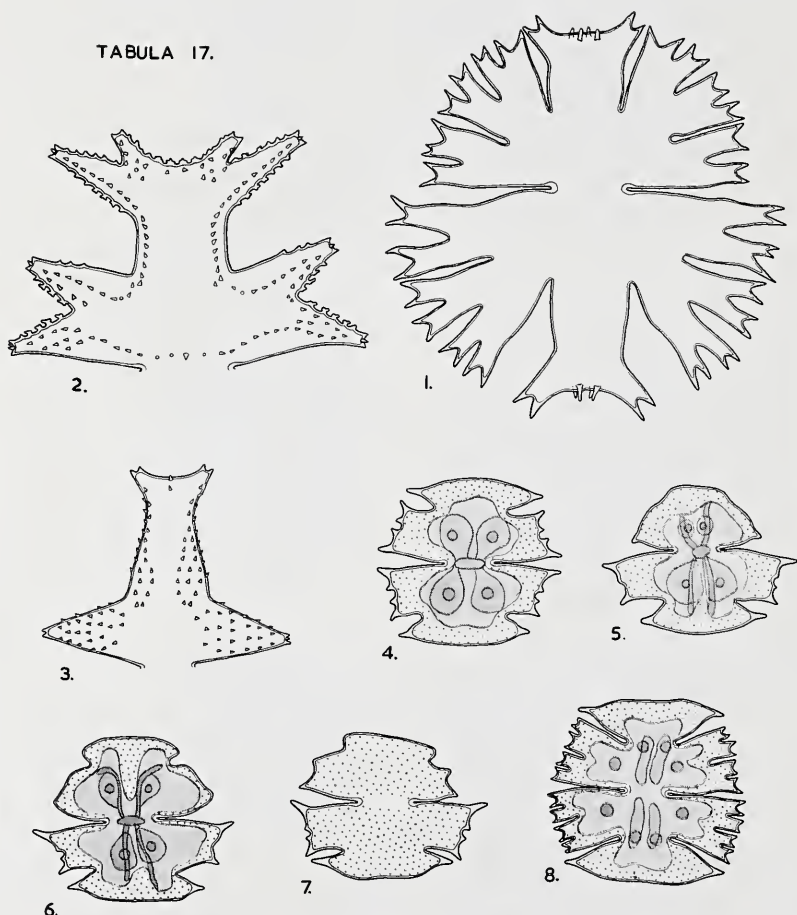
a ————— 40 $\mu$ b ————— 40 $\mu$

TABULA 16.



— 40 $\mu$ .

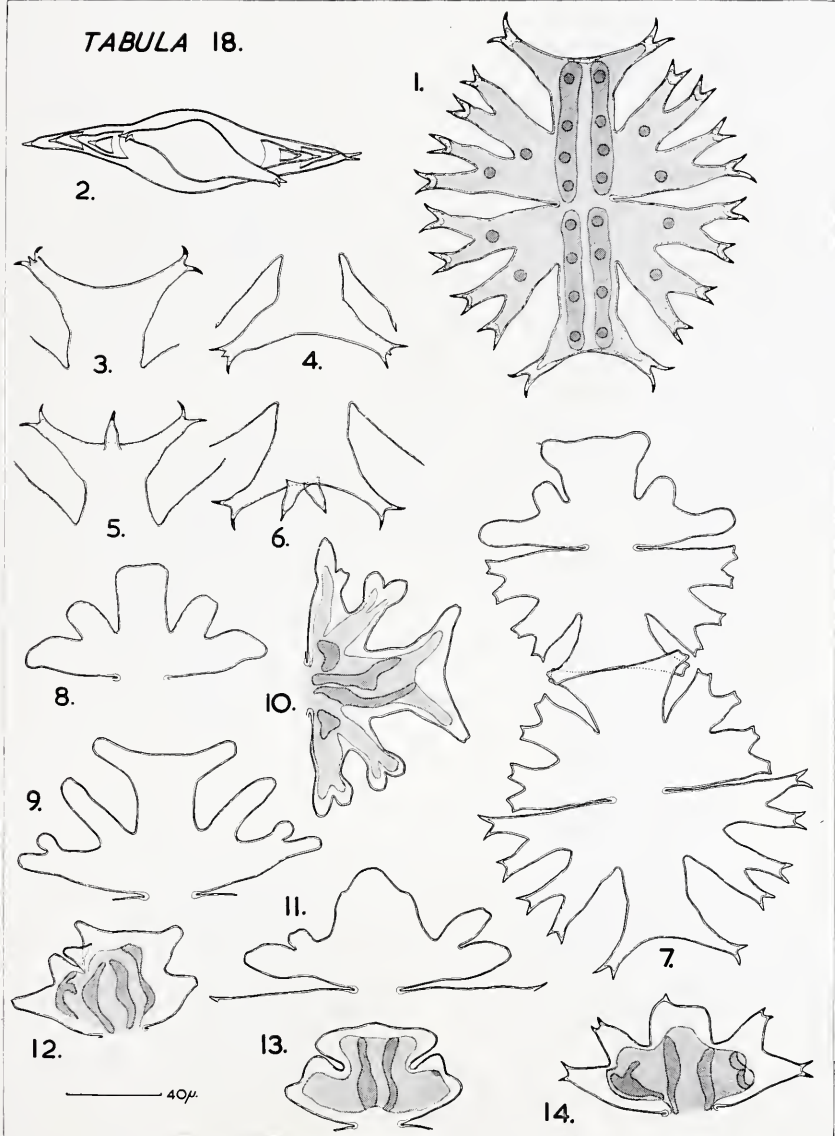
TABULA 17.



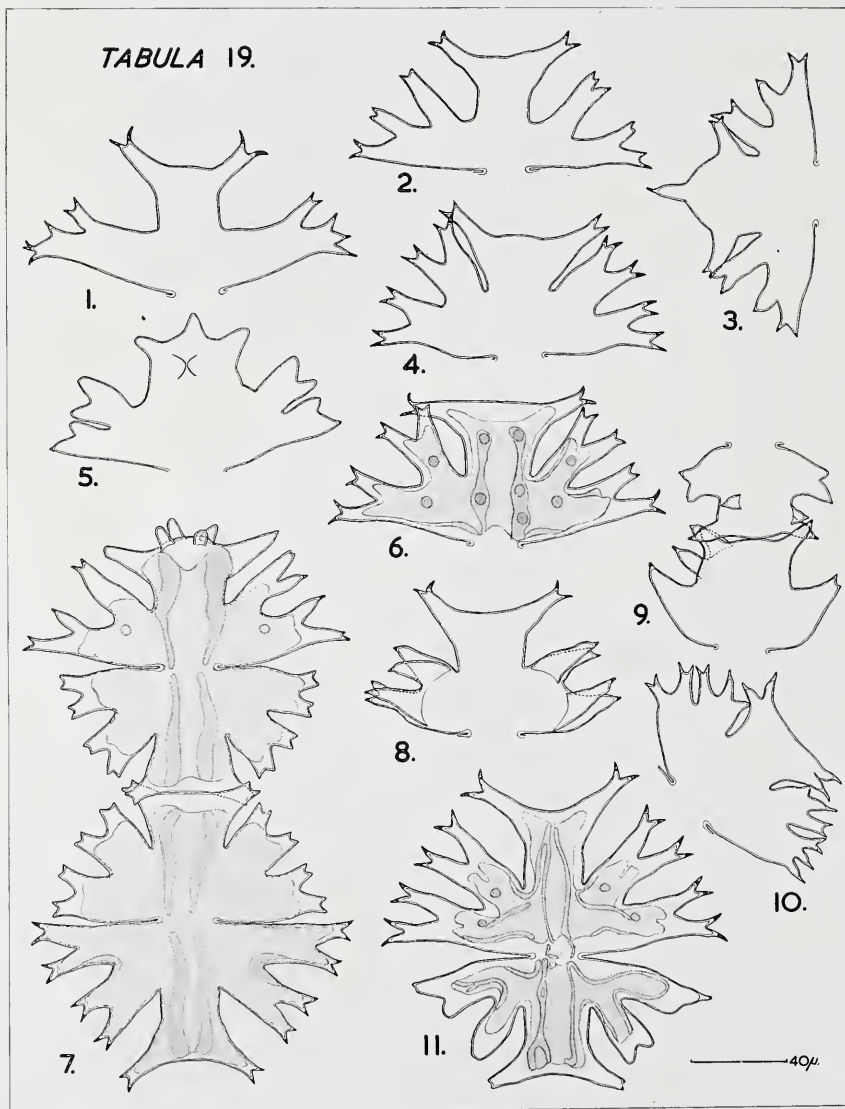
— 80 $\mu$ .



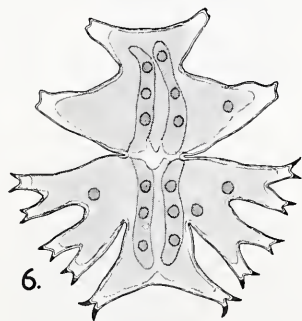
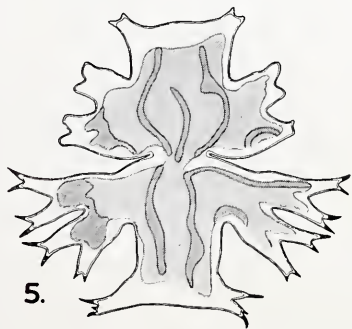
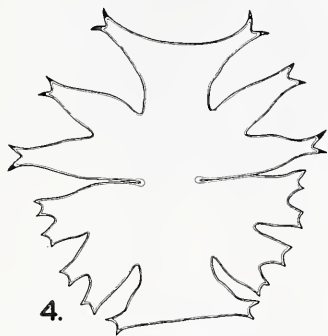
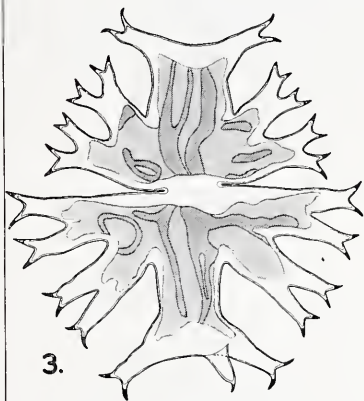
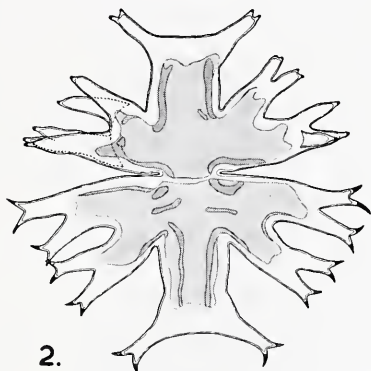
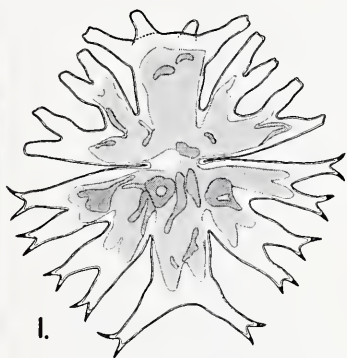
TABULA 18.



TABULA 19.

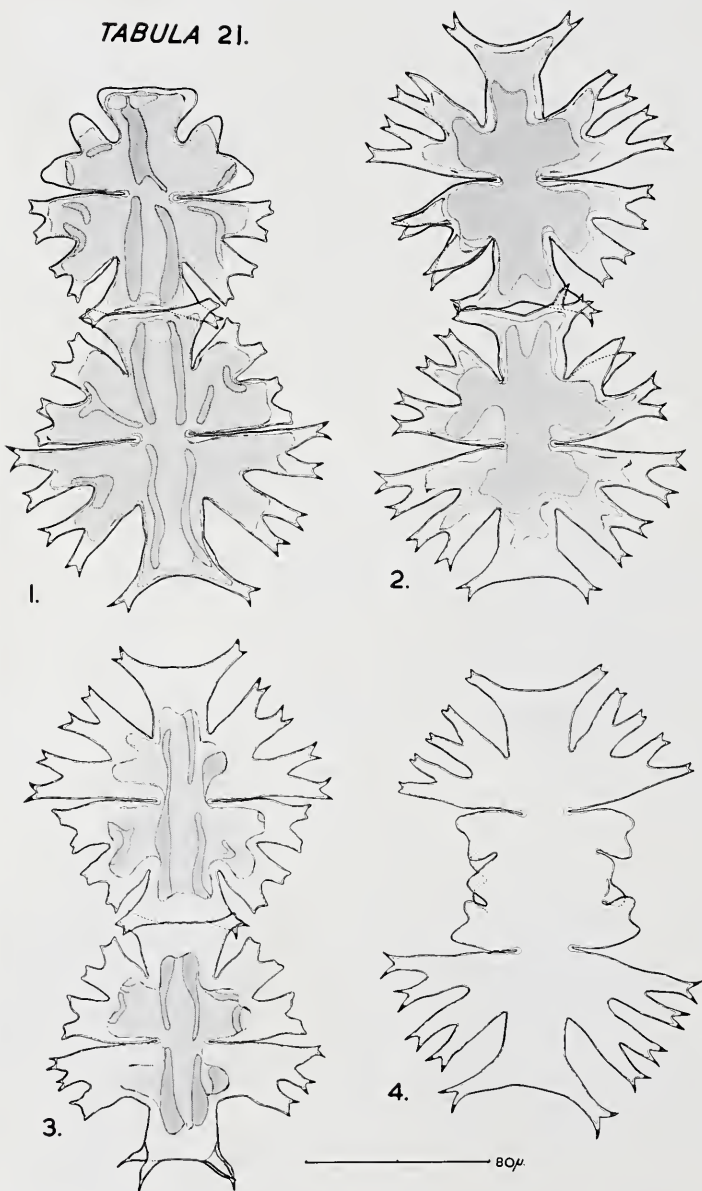


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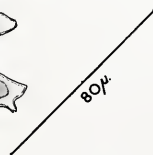
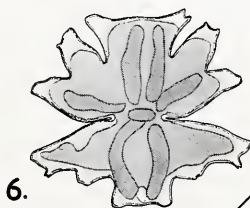
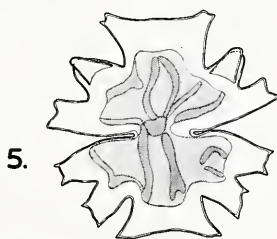
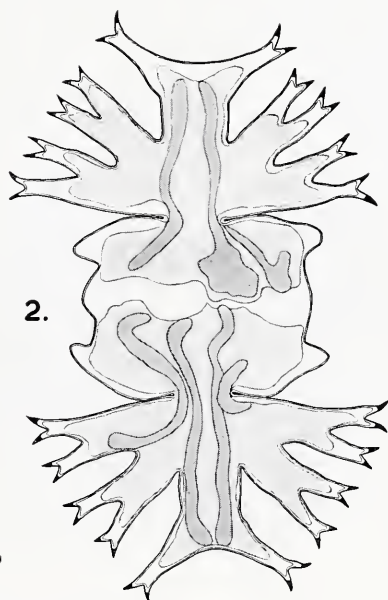
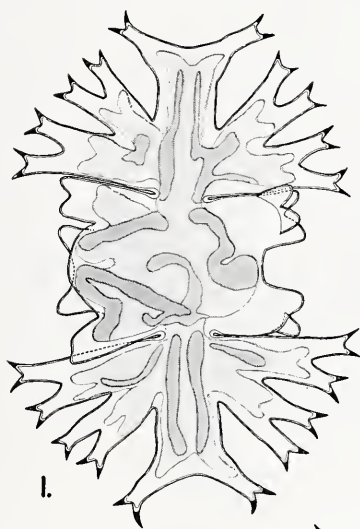
— 80 $\mu$

TABULA 21.

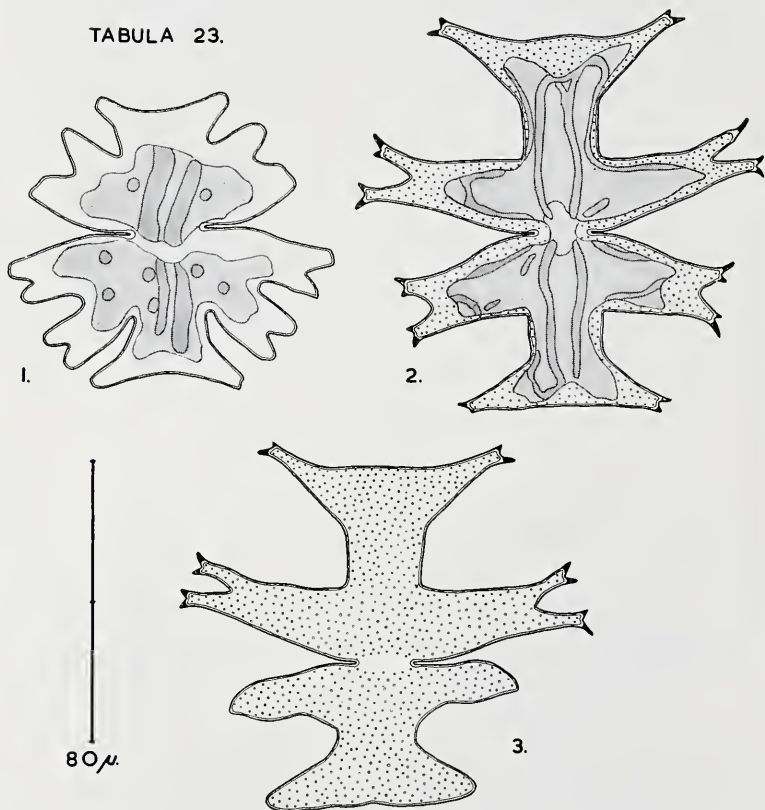




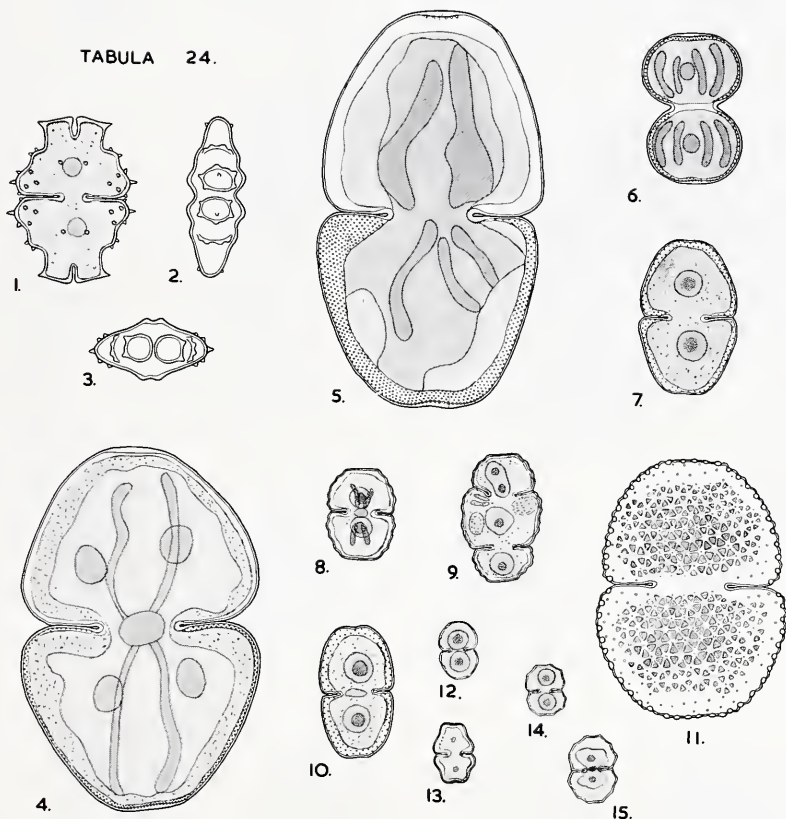
TABULA 22.



TABULA 23.

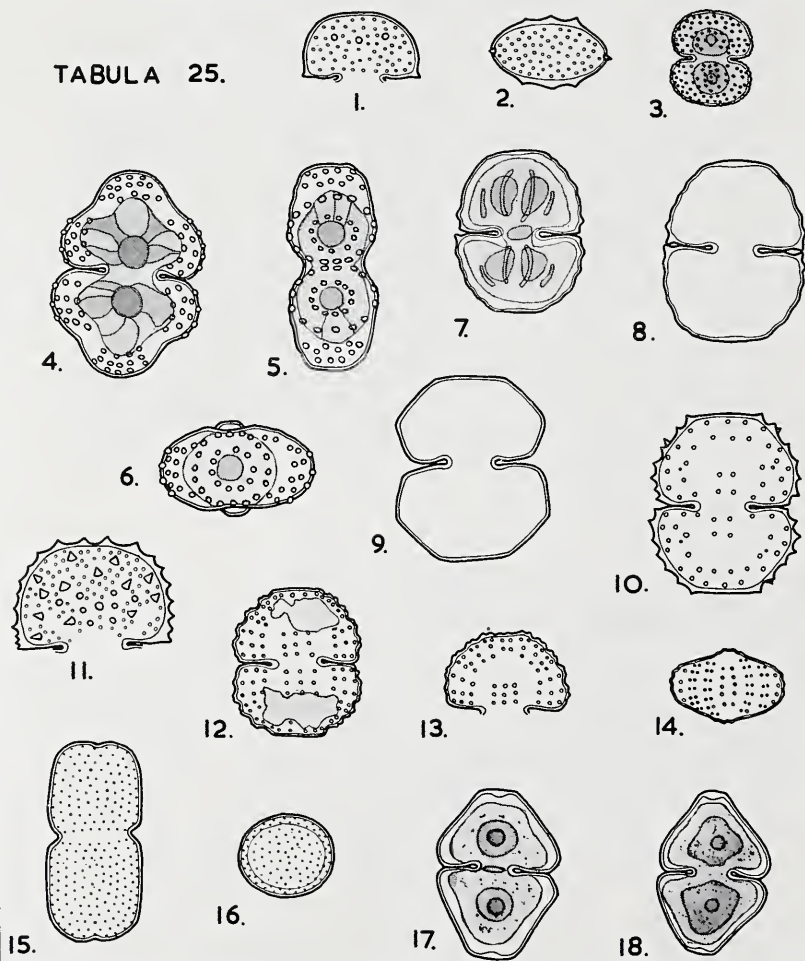


TABULA 24.



a.  $\text{---}$   $40\mu$   $\text{---}$  b.

TABULA 25.

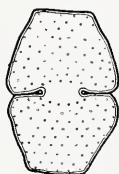


a. ————— 40 $\mu$  ————— b.



TABULA 26.

40  $\mu$ . a.  
b.



1.



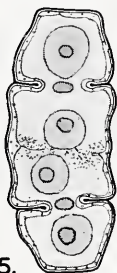
2.



3.



4.



5.



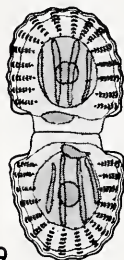
6.



7.



8.



9.



10.



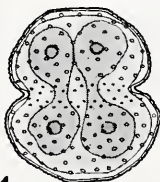
11.



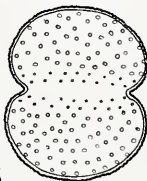
12.



13.



14.

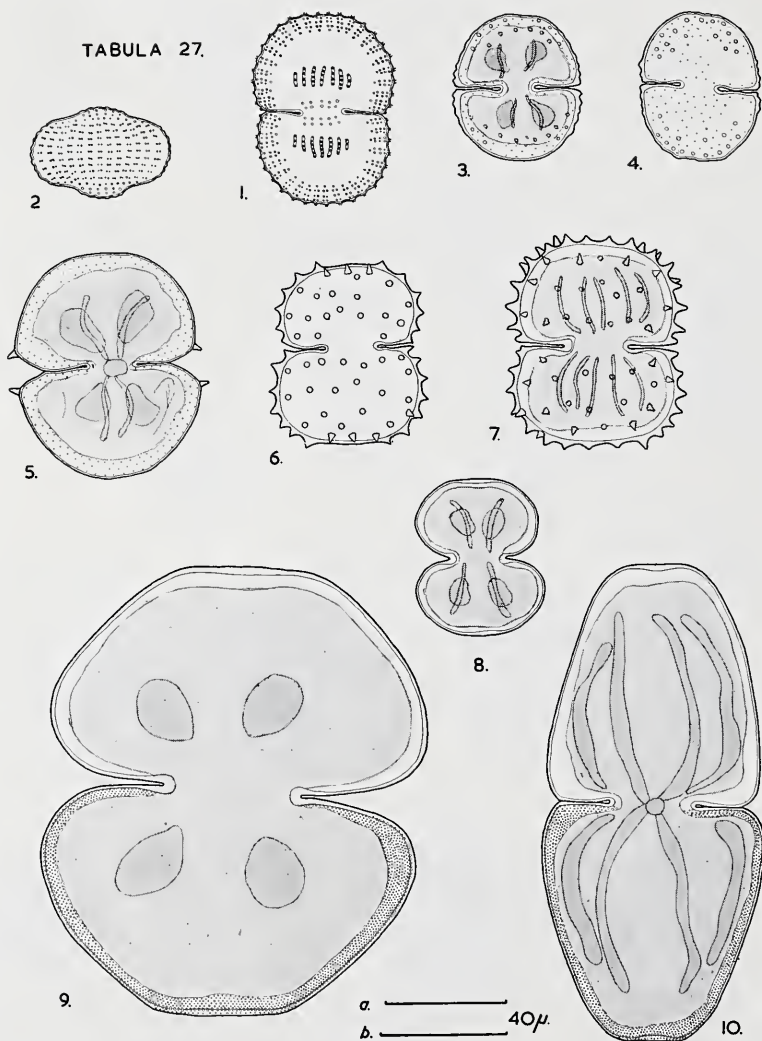


15.

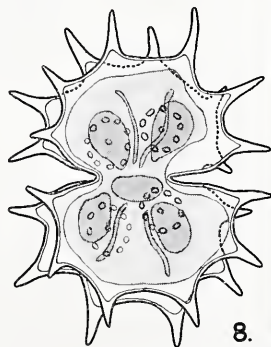
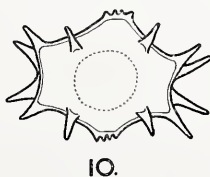
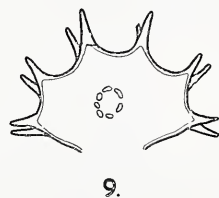
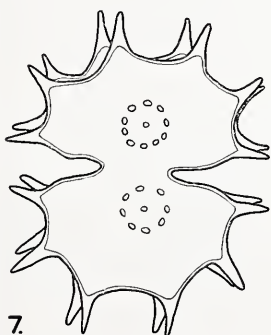
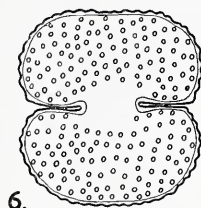
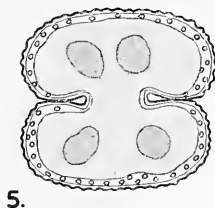
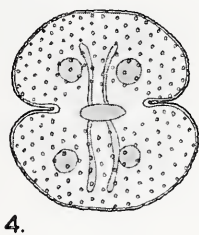
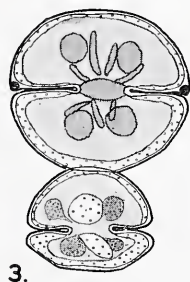
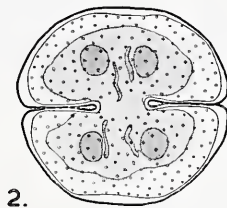
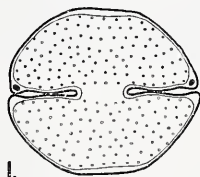


16.

TABULA 27.



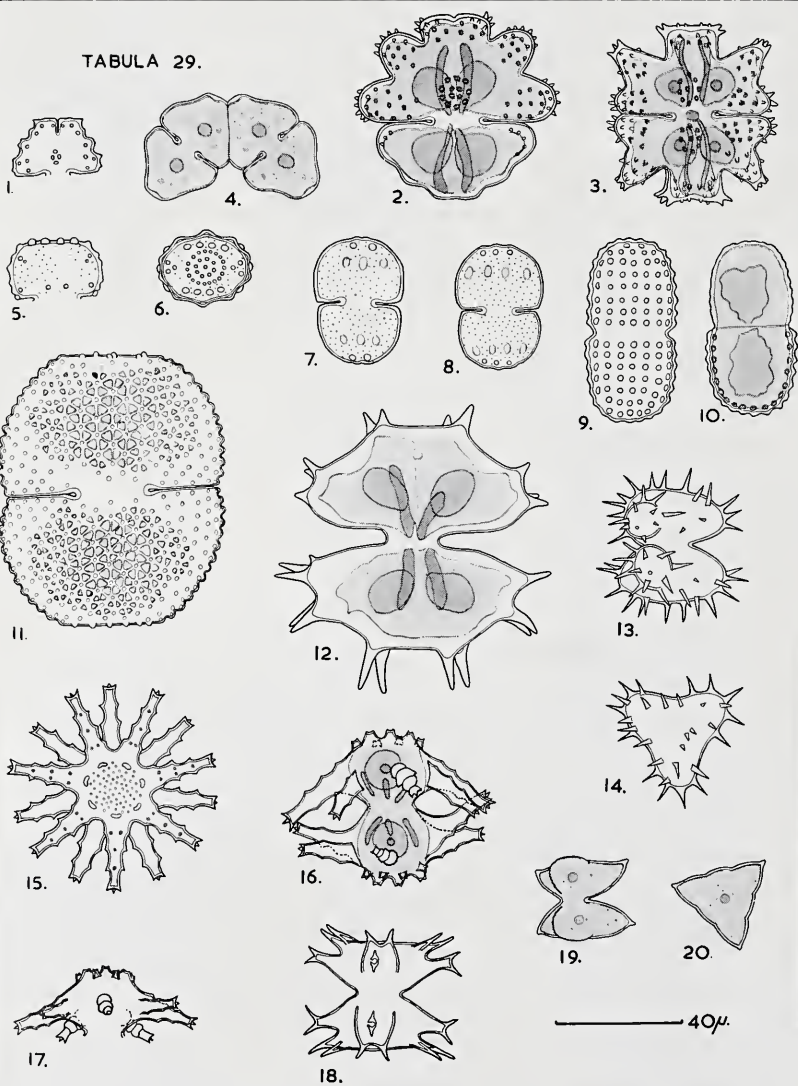
## TABULA 28.



a. 40μ.

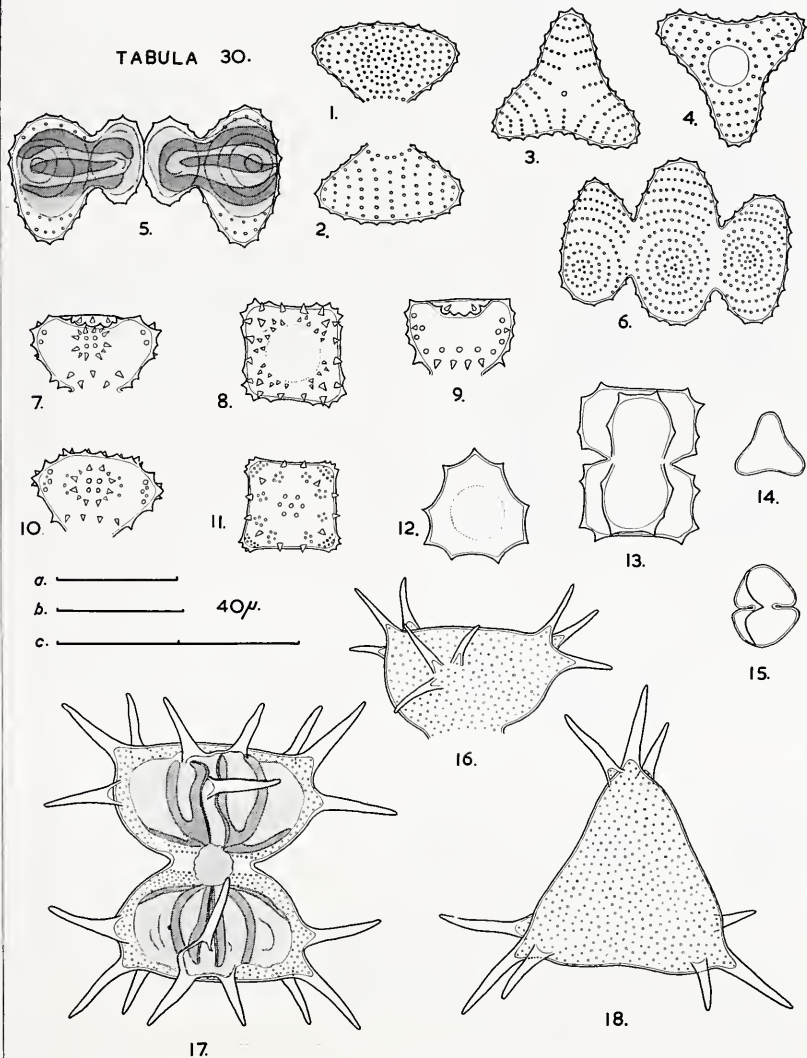
b. 40μ.

TABULA 29.

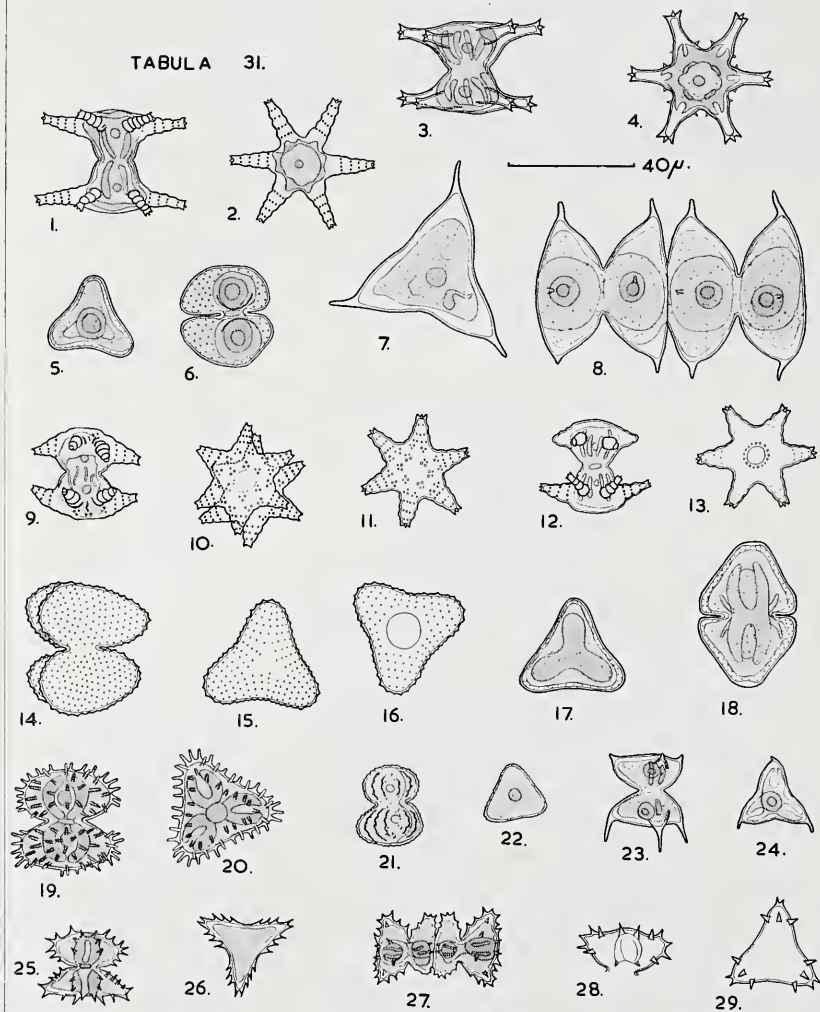




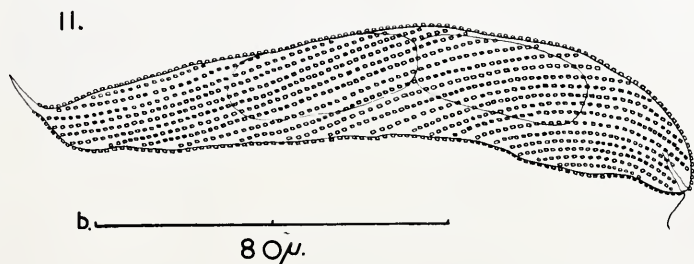
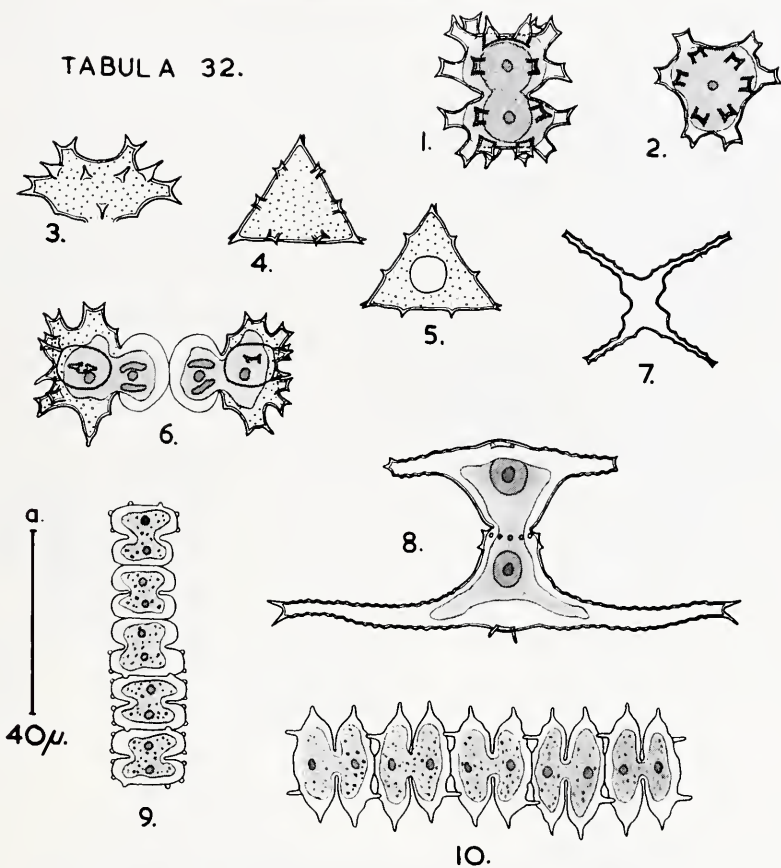
TABULA 30.



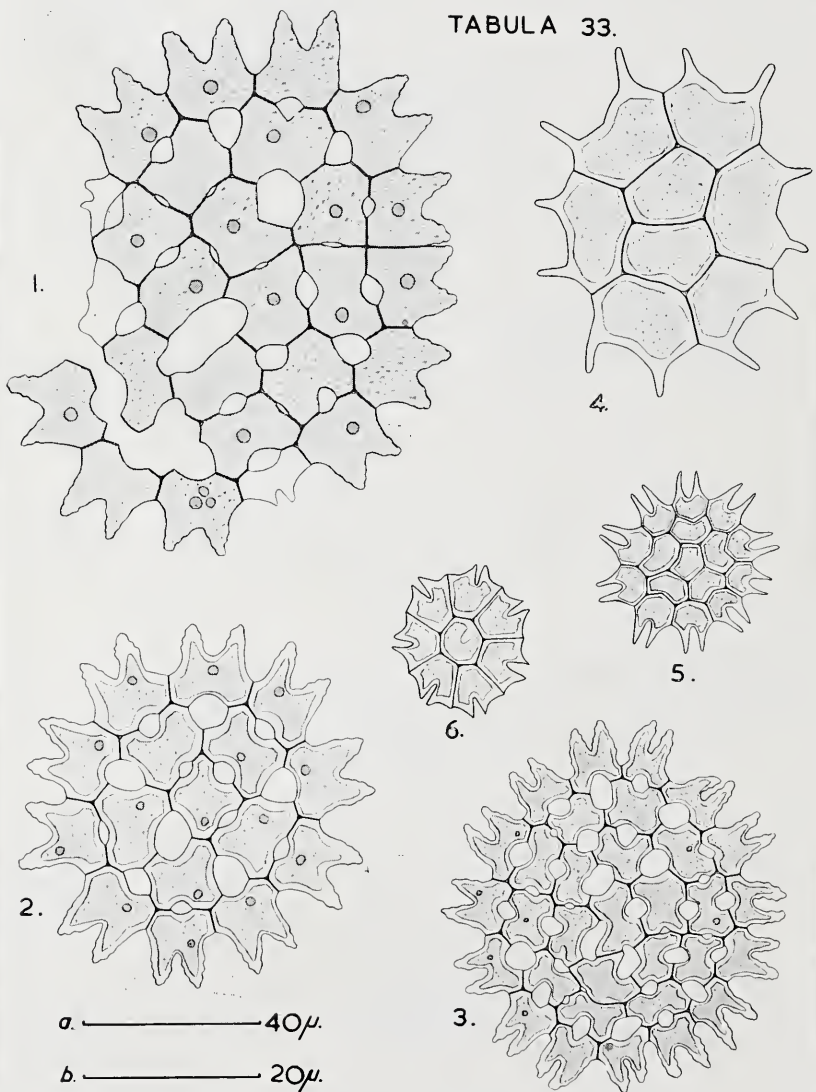
TABULA 31.



TABULA 32.

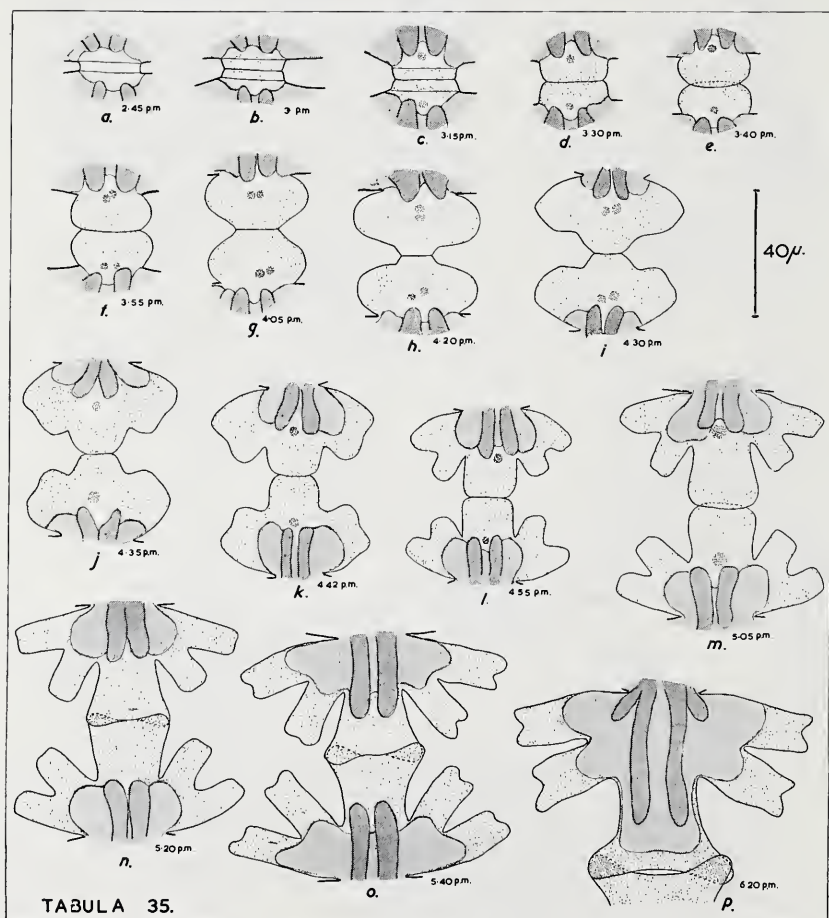


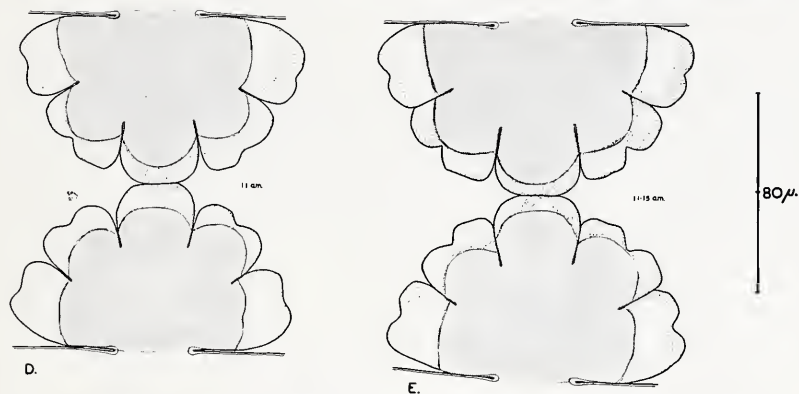
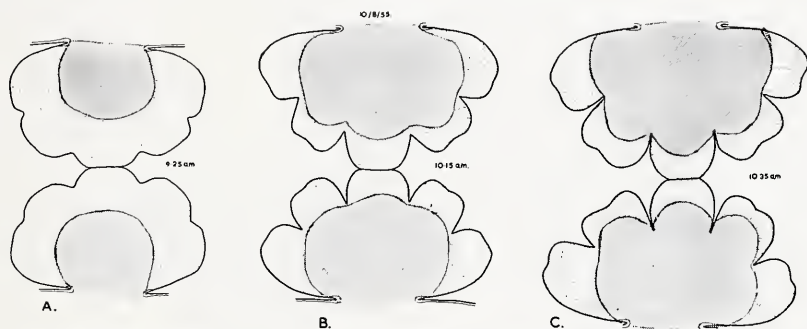
TABULA 33.



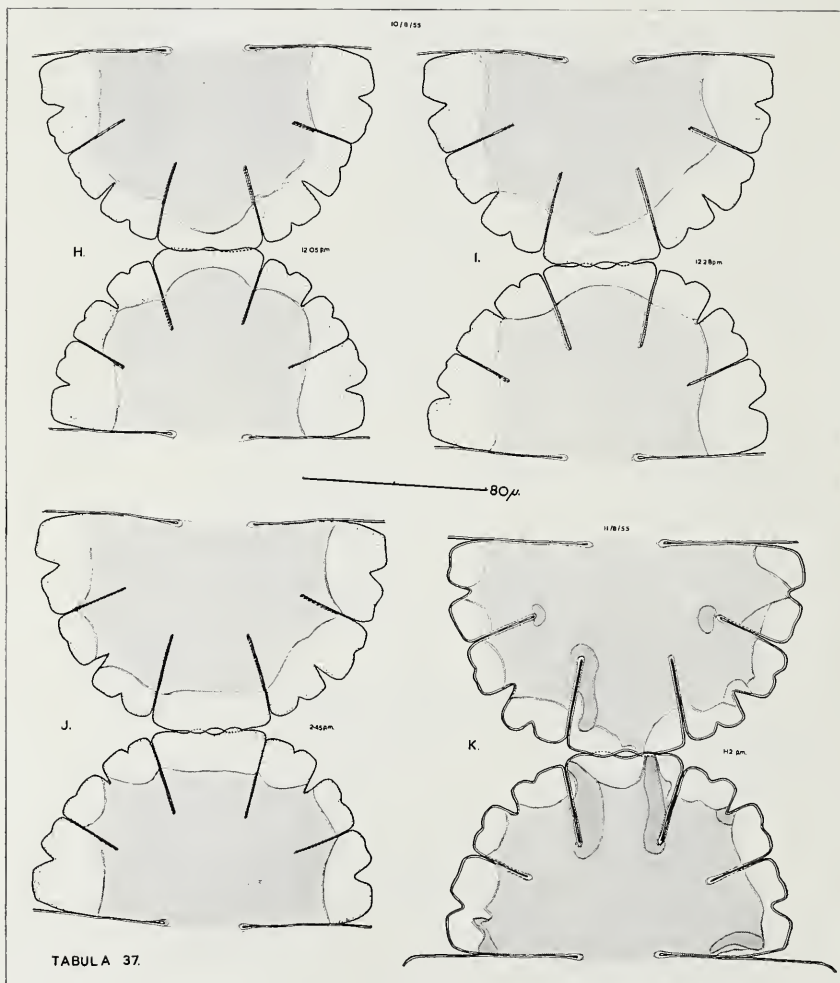








TABULA 36.





## Review

*Flora Zambesiaca*, Volume I, Part I, published by the Crown Agents, London; 366 pp. including illustrations. Price 25s.

The title *Flora Zambesiaca* is an appropriate one for an international project of this kind dealing, as it does, with the flowering plants of territories linked by one of Africa's greatest rivers. The project is sponsored by the governments of Britain, Portugal and the Federation and deals with the territories of the Federation of Rhodesia and Nyasaland, Mocambique and the Bechuanaland Protectorate. The *Flora* is produced by an editorial committee consisting of Dr. H. Wild of the Federal Herbarium, Salisbury, Mr. A. W. Exell of the British Museum (Natural History), Mr. J. P. M. Brenan of Kew and Dr. F. A. Mendonca of Portugal. The whole production is of a very high standard with an attractive format which could well serve as a model of its kind.

Included in this first part is a brief history of botanical exploration in the area, a selected bibliography, a glossary of botanical terms, a key to plant families, a map of the area and 58 excellent line drawings illustrating most of the genera described. The arrangement follows the Bentham and Hooker system and the families now dealt with extend from the Cycadaceae to the Polygalaceae, covering some 90 genera and 306 species. The text results from the collaboration of the following authors: G. Cufodontis (Pittosporaceae), A. W. Exell (Papaveraceae, Fumariaceae, Cruciferae, Polygalaceae), A. W. Exell and E. Milne-Redhead (Ranunculaceae), John Lewis (Gymnospermae), F. A. Mendonca (Nymphaeaceae), N. K. B. Robson (Annonaceae, Violaceae), P. Taylor (Resedaceae), G. Troupin (Menispermaceae) and H. Wild (Dilleniaceae, Berberidaceae, Cabombaceae, Capparidaceae, Bixaceae and Flacourtiaceae).

It is clear that a single publication dealing with the flowering plants of the whole of tropical Africa on the scale of the old *Flora of Tropical Africa* is too great a task for a single institution or government to undertake. Thus regional Floras have been embarked upon, based mainly on political subdivisions, and the *Flora Zambesiaca* is the most recent of these. To the north of the region covered, there is in progress the *Flora of Tropical East Africa*; to the north-west, the *Flore du Congo Belge et Ruanda Urundi*; and to the west, the *Conspectus Florae Angolensis*. To the south, work has started on a *Flora of Southern Africa*, the first part of which is nearly completed.

So little revisionary work has been done on African plants that it becomes necessary to carry out a small revision on practically every family dealt with. This is time-consuming work because, in order to arrive at the correct name to use for a species, variation must be studied throughout its entire range. The more thoroughly this is done, the more valuable will the publication be. Much of the earlier monographic work on African plants is unrealistic in that too many species are maintained on slender distinctions that are not supported by a study of the living plants in the field, or when a wider range of material has become available to the herbarium botanist. Even with the more extensive material now available, the delimitation of species limits in accordance with reality calls for good judgement. In both respects of thoroughness and judgement regarding species delimitation, the *Flora Zambesiaca* inspires confidence. Not only will botanists and field workers in the territories concerned find this a most valuable publication, but also those in adjoining territories.

One of the very few criticisms that can be made relates to the treatment of *Encephalartos vil osus* (Gaertn.) Lem., because the plants classified under this heading were separated some years ago as *E. umbeluziensis* R. A. Dyer.

L. E. CODD

## Addendum

### **Cladophora**

#### **Cladophora isaacii** *Simons*, sp. nov.

In *Bothalia* 7: 194 (1960) the above species was described, with a Latin diagnosis, and figured, but a type specimen was not designated. This omission is now rectified in order to validate the species.

CAPE PROVINCE.—Malmesbury District: Paternoster Bay, in mid- and upper-level pools, *Simons* in National Herbarium, Pretoria, algal collection No. 2407 (PRE, holotype).

R. H. SIMONS

# A Revision of the South African Species of *Anthericum*, *Chlorophytum* and *Trachyandra*

By

A. Amelia Obermeyer

## INTRODUCTION

The genus *Anthericum* was described by Linnaeus in his *Species Plantarum*, Ed. 1, p. 310 (1753), to receive two well known European species, *A. ramosum* and *A. liliago* [previously known as *Phalangium*, Tournefort, Inst. 368, t.193 (1700)], four South African species now classified under *Bulbine*, a tumble-weed from the Cape (*Trachyandra revoluta*) and two European species at present placed under *Narthecium*. The concept was a wide one, with the result that in time many and varied species were added to it on the one hand, while on the other, groups of species were withdrawn to form separate genera. *Bulbine* was again raised to generic rank by Willdenow in 1800.\* The genus *Chlorophytum* was segregated in 1808 by Ker Gawler and *Caesia* by R. Brown in 1810. In 1843 Kunth discarded the genus *Anthericum* altogether and divided what was left into three genera, *Phalangium*, *Bulbinella* and *Trachyandra*, whilst he upheld *Bulbine*, *Chlorophytum* and *Caesia* and some other genera outside Africa, which do not concern us here. His genus *Phalangium* was the equivalent of what is now accepted as *Anthericum* L. The European species *A. ramosum* and *A. liliago*, which were known to Linnaeus and which fit his generic description, especially that of his later works, form the basis of this genus. In 1936 Green proposed that *A. ramosum* L. should be regarded as the type species.

Baker in his monograph on the Liliaceae [Trans. Linn. Soc. 15 : 253 (1876)] went back to *Anthericum* in a much broader sense (but not quite in the Linnaean circumscription for he recognized *Chlorophytum*, *Caesia* and *Bulbine*) and sank Kunth's genera *Phalangium*, *Bulbinella* and *Trachyandra*. In the *Flora Capensis* in 1896, he raised *Bulbinella* again to generic rank. Thus *Anthericum* in the *Flora Capensis* consisted of the sections, *Phalangium* and *Trachyandra*, whilst at the same time Baker placed certain species in a new section *Dilantes*, which will be discussed later.

When examining the South African species in and related to *Anthericum*, it was found that species of *Trachyandra* Kunth were so different from typical *Anthericum* L. that it was decided to restore the genus. Far more difficulty was experienced in separating *Chlorophytum* from *Anthericum*. These two genera are rich in species and have a world-wide distribution. It is outside the scope of this revision to decide whether *Chlorophytum* should be made a section of *Anthericum* as suggested by Duthie [Ann. Stell. Univ. 4 : 1 (1926)], Perrier [Notulae Syst. Vol. V, p. 33 (1955)] and others. The seeds of *Anthericum* are small and angular, usually numerous and this distinguishes it from *Chlorophytum*, which has large flat seeds, very similar in appearance in all species. Further, the trigonous capsules, the rosulate leaves, the bracteate scape and the spongy roots usually combine to distinguish *Chlorophytum* from *Anthericum*, but, with the exception of the seed, one or two of these features may be absent. An example of this is for instance *Chlorophytum rigidum* Kunth, which has the leaves somewhat distichous and the pedicels articulated near the base, both features of many species of *Anthericum*. But its seeds are flat, for which reason it is best kept under *Chlorophytum* for the present.

\* In Hort. Cliff. 122 (1735) Linnaeus had created the genus *Bulbine* for *B. caulescens* but in his Sp. Pl. (1753), he placed it under *Anthericum*. Jussieu's conception on the nomenclature of these genera differs from the modern accepted view. In his work, *Genera Plantarum* 1789, he regards *Bulbine* Willd. to be *Anthericum* whilst the true *Anthericum* L. (1753) was identified by him as *Phalangium*. Poiret in Lam. Encycl. (1804) and Persoon, Synopsis (1805), both follow Jussieu's classification.

A small number of species from the south western Cape regarded as *Anthericum* by Baker but which show a closer affinity to *Chlorophytum*, are here transferred to this genus. Kunth adopted this view with those species that were known to him, and Adamson and Salter in their Flora of the Cape Peninsula regarded *Anthericum triflorum* as a *Chlorophytum*. This had been suggested by Duthie. In notes published posthumously (Gen. Pl. Fragm. 70, 1866), Salisbury had also noticed the difference between species now placed in the genus *Trachyandra* (he probably was not aware of Kunth's genus at the time) and the true *Anthericum* species. He described a new genus *Dilanthes* and mentioned that *A. revolutum* and other closely related species should go into that genus. It must be regarded as a synonym of *Trachyandra*. Baker apparently did not recognize it as a synonym of *Trachyandra* and made it a section for the south western Cape species of *Chlorophytum* and those of *Anthericum* he thought possessed rough filaments. However, *A. polyphyllum*, *A. galpinii*, *A. multisetosum* and *A. robustum*, mentioned by Baker in this section, have glabrous filaments. This heterogeneous section cannot therefore be upheld.

Duthie's article on the species of *Anthericum* and *Chlorophytum* of the Stellenbosch Flats [Ann. Stell. Univ. 4, A, 1 : 1-23 (1926)], giving detailed descriptions of 13 species (9 species of *Trachyandra*, 3 of *Chlorophytum* and 1 of *Anthericum*) occurring in this area is most informative. Similarly the 20 species enumerated in the Flora of the Cape Peninsula by Adamson and Salter must be mentioned as a valuable contribution to our knowledge of these genera. While at Kew in 1950, Pauline Kies began a revision of these genera. After her marriage I continued with this work and as I have introduced many modifications I feel I must take full responsibility for the present account.

#### KEY TO GENERA

Inflorescence central; flowers one to many-nate (if solitary, supported by 2 bracts); pedicels articulated; perianth persistent; anthers basifixed, large; seeds with a black, shiny, granular testa; leafbase folded, not tubular:

Seeds small, globose, irregularly compressed with many folds 1. *Anthericum* (p. 670)

Seeds large, round and flat with a pointed hilum. 2. *Chlorophytum* (p. 690)

Inflorescence axillary; flowers single, each supported by one bract; pedicels not articulated; perianth deciduous, only the base persisting as a small cup or rim if a capsule is formed; anthers versatile, small; seeds angular, grey or brown, smooth or verrucose, often glutinous when ripe; leafbase tubular

3. *Trachyandra* (p. 711)

#### 1. ANTHERICUM

Linn. Sp. Pl. ed. 1 : 310 (1753); Gen. 422 (1754). Baker in J. Linn. Soc. 15 : 290 (1876); Fl. Cap. 6 : 378 (1897); Fl. Trop. Afr. 7 : 477 (1898) sensu lato. Benth. & Hook. Gen. Pl. 3, 2 : 788 (1893) sensu lato. Krause in Engl. & Prantl, Pflanzenfam. 15, A : 282 (1930) sensu lato. Phillips, Genera of S.A. Flow. Pl. 2nd ed. 183 (1951) sensu lato.

*Phalangium* Juss. Gen. Pl. 52 (1789). Poir. Encyc. Meth. 5 : 242 (1804). Kunth, Enum. 4 : 593 (1843). Salisb. Gen. Pl. Fragm. 70 (1866).

Herbaceous perennials, the parts above ground dying down in winter. *Roots*, many, long, thin, fibrous often with scattered watery tubers near the tips, sometimes fairly sturdy and woody, rarely swollen, cylindrical and fairly short (*A. calyptrocarpum*). *Rhizome* usually creeping, knobby, often covered with fibres (the remains of old leaf bases). *Leaves* distichous or rosulate; in the distichous species there are usually about 8, the primary leaves small, sometimes hairy, the later leaves becoming progressively larger; in the rosulate species the leaves are numerous; bases sometimes dilated, membranous, folded (never tubular); lamina flat or folded, rolled or terete, glabrous



or hairy, rarely glandular. *Inflorescence* central, simple or branched, usually overtopping the leaves; scape flattened, sometimes narrowly winged and usually naked in distichous-leaved species or terete and bracteate in rosulate species; lower bracts in compound inflorescences usually large, leaf-like, the fertile bracts much smaller; in a few species 2-keeled bracteoles present; pedicels articulated near the base or near the middle, lengthening at anthesis. *Flowers* in axillary fascicles each surrounded by bracts; in a few species flowers solitary, subtended by a bract and bracteole; flowers in each axillary fascicle opening consecutively; open all day, seldom opening in the afternoon (*A. calyptrocarpum*). *Perianth* rotate, white, rarely greenish, shiny, consisting of watery, translucent cells, the dark median keel usually appearing when the flower fades; the 3 outer segments slightly narrower than the 3 inner, marcescent, covering the capsule when it ripens. *Stamens* 6, adnate to the very base of, and slightly shorter than the perianth segments; filaments glabrous or papillate in the upper half, usually flattened below; anthers large, basifixed, the base at the back of the anther forming a rimmed pit where the filament is inserted; anthers introrse and curling backwards when fading. *Ovary* sessile, globose with about 10-30 biseriate ovules; with septal glands; style filiform often slightly dilated in upper half, smooth, often declinate; stigma minutely penicillate or capitate. *Capsule* loculicidally 3 valved, globose, obtuse, apiculate or beaked, smooth or with transverse ridges (the number of ridges roughly corresponding with the number of ovules). *Seeds* small, irregularly angled, minutely granular, black; embryo cylindric, endosperm firm.

**DISTRIBUTION:** A few species in southern Europe and northern Africa; many found in tropical Africa extending southwards, one species being recorded from Cape Town. A few are also recorded from central America.

**Type Species:** *A. ramosum* L.

Typical European species bear racemes with solitary flowers, supported by one bract in each axil, whereas our tropical and subtropical species have several bractiferous buds clustered in each axil, or, if reduced to one flower, with at least two semi-opposing bracts. *A. ramosum* L. and *A. liliago* L., the typical species, moreover have 8 chromosomes whereas our South African species have 7 as far as is known. Kunth placed the species with the fascicled buds in a separate second section [Enum. Plant. 4 : 595 (1843) under *Phalangium*] and added here the South American species, some from India and two doubtful ones.

The South African species of *Anthericum* may be regarded as southern off-shoots of tropical members which migrated south; on reaching the drier, colder parts of the highveld, they became small and stunted, the Karroo effectively barring further expansion. These small impoverished highveld plants lose many of their usual characteristics and are often difficult to distinguish. It is likely that the effect of the frost, fires and drought affected some features i.e. hairiness, size, etc. An example is *A. galpinii* which grows up to 3 feet high in the eastern Transvaal lowveld and produces divaricately branched racemes, whereas some specimens, including the type, are only 8 inches high and have nearly simple racemes. Similarly I have come to the conclusion that *A. multisetosum*, *A. rubrovittatum* and *A. robustum* are merely small or tall forms of one species, *A. angulicaule*; the shape of the flowers, bracts, pedicels and capsules remains constant.

Several species e.g. *A. cooperi* and *A. fasciculatum*, have adapted themselves very well to the eastern highveld where they are common although usually small. C. E. Moss studied the genus for many years and I had the privilege of reading his manuscript notes which are preserved at the Moss herbarium of the University of the Witwatersrand. The variability of these eastern highveld species led Moss to suggest that "although no actual experiments appear to have been performed in connection with the matter, specimens occur which are difficult to account for on any hypothesis other than that they are hybrids or hybrid segregates."\* I found that the numerous species described

\* Duthie's statement in Ann. Stell. Univ. 4, A. 1 : 3 (1926) that "no indication of hybridisation has been met with" is not contradictory for she dealt mainly with *Trachyandra* species.

by Baker and others were often forms of one variable species and consequently reduced the number of species considerably. Even so when using the key, it will not be found easy to determine a stunted specimen which has lost many of its characteristics. I agree with Moss that it is likely that *A. cooperi*, *A. saundersiae*, *A. fasciculatum* and *A. galpinii* hybridize. It would for instance, account for the variability of the filaments in some of the species from the Drakensberge near van Reenen. *A. cooperi* and *A. capitatum* were described from plants collected in that area and the only difference seems to have been that *A. cooperi* had smooth filaments while in *A. capitatum* they were rough in the upper half. Similarly *A. nudicaule* was also separated from *A. cooperi* because of its rough filaments but N. E. Brown pointed out that even some plants on the type sheet of *A. nudicaule* had smooth filaments. In *Anthericum* the filaments are constant for each species, smooth or rough. So their variability points to a crossing of two species, one with smooth and the other with rough filaments. The filaments of the specimens of *A. cooperi* found on the Transvaal highveld are smooth, so possible parents of the mixture found near van Reenen could be *A. cooperi* on the one hand and either *A. saundersiae* (from the lower regions of Natal) or *A. fasciculatum* (a highveld species) on the other, these both with rough filaments. *A. fasciculatum* and *A. galpinii* probably also hybridize at times. It would be interesting to investigate these species to see if they do hybridize easily and also to study their polymorphism with regard to factors inhibiting growth, like frost, fires and drought. It was felt that the systematic work on these closely related species could not be solved satisfactorily in the herbarium and that there is need for research work in the field.

**GEOGRAPHICAL NOTES:** Seventeen species of *Anthericum* were found to occur in southern Africa. Of these three are confined to the Transvaal; *A. trichophlebium* has been found mainly around Pretoria and Johannesburg; it is related to *A. whytei* but segregated geographically and it is much smaller than its northern relative. The second, an interesting new species, *A. cyperaceum* is at present only known from the Transvaal bushveld. Its congested inflorescence resembling a cyperaceous plant is unusual. A third species, *A. radula* from the Woodbush in the Transvaal, found by Rehmann, has not been collected again. All the other species show a wide range, some being recorded from localities over a thousand miles apart. *Anthericum calypitocarpum* for instance was described from Angola but it is also found in South West Africa, eastern Southern Rhodesia and near Pretoria. *Anthericum whytei* was described from Nyasaland but shows a continuous distribution through the Zambesi country to South West Africa. *A. anceps* is found in Southern Rhodesia and northern South West Africa. It is very closely related to a polymorphous widespread species from the eastern highveld, *A. cooperi*. Here too probably, geographical isolation caused them to become somewhat different. One other species worth mentioning is *A. rangei* Engl. & Krause; it was described from South West Africa but has been found south as far as the Cape Peninsula (where incidentally it flowers in summer). It is very unobtrusive and was described as *A. scariosum* by Duthie in 1926. Although the type of *A. rangei* from South West Africa was probably destroyed during the Second World War, the description and the record of intermediate localities between the Cape and South West Africa, made me decide to consider them one species. It is the only true *Anthericum* species found so far south. All the other species found in the winter rainfall area usually described as *Anthericum* species, belong either to *Trachyandra* or *Chlorophytum*.

Superficially the South African species could be grouped into two sections, but several species form links between these two groups. The members of the first group have distichous leaves and a usually compressed, naked scape, the flowers are arranged in fascicles in the axils of large bracts and the capsules are round and obtuse. In the second group the leaves are rosulate and the terete scape bears bracts. In *A. transvaalense*, *A. radula*, *A. longistylum* and *A. haygarthii*, which come under this latter

group, the flowers are solitary, with an outer bract and an inner 2-keeled bracteole and the capsule is beaked. Intermediate forms are *A. krauseanum*, *A. rangei* and *A. calyp-trocarpum*, which have the leaves rosulate and the terete scape bracteate, but the flowers are not always solitary nor is the capsule always beaked (for in *A. krauseanum* it is globose and with transverse ridges similar to those of the first section). A further link is made by *A. acutum* which has the leaves more or less distichously arranged and the flowers clustered but its capsule is beaked.

#### MORPHOLOGY

**Roots:** They are usually very abundant, nearly always thin, and often with watery tubers near the tips. (These are usually left behind when the plant is pulled out of the ground). I presume that these tubers are produced during the summer months and are used for water storage. *A. angulicaule* and *A. cyperaceum* have the roots more sturdy and no tubers were seen on the herbarium specimens. *A. calyp-trocarpum* with its swollen roots is an exception. No plants showed the production of the long root hairs so often found in *Chlorophytum* and *Trachyandra*.

**Rhizome:** It is horizontal and knobby, each shoot arising from a nodular, woody base. It is nearly always covered with fibres from old leaf bases.

**Leaves:** In the distichous species there are about 8, the outer very small, the inner ones becoming progressively larger. They clasp at the base but are never tubular. The veins are usually prominent. Sometimes the two outer veins fuse giving the leaf a prominent, usually yellow margin.

**Inflorescence:** In the distichous-leaved species the flowers and their bracts are arranged in small clusters in the axils of larger bracts. Actually these clusters, spirally arranged on the rhachis, represent repressed side branches. Occasionally in some species, e.g. *A. anceps*, *A. saundersiae*, *A. fasciculatum*, etc., a basal cluster may elongate; the flowers on this branch are then usually distichously arranged.

In the four closely related species *A. longistylum*, *A. radula*, *A. transvaalense* and *A. haygarthii* the flowers are always solitary with an outer bract and an inner 2-keeled bracteole. The inner bracteole in the 2 last mentioned species is not situated exactly opposite the outer bract, but to one side, probably as a result of the spiral arrangement of the raceme; the inner bracteole may have two horns or in *A. haygarthii* an oblique one-sided horn. In this rosulate group the scape is terete, with the lower bracts leaf-like, the upper becoming progressively smaller. In the distichous species the scape is usually compressed and naked and the lowest bract of the inflorescence is large, the following floral bracts being much smaller.

The species all have articulated pedicels. The articulation is found usually below the centre in our species. A specimen of *A. acutum* collected by Werdermann showed two small bracts produced at the articulation. An articulated pedicel may therefore be interpreted as a peduncle bearing a pedicel on top. It is usually this upper part, the pedicel proper, which elongates during the flowering and the fruiting stage. The inflorescences of these African species therefore appear to be the result of the reduction of a very complex inflorescence. As in *Chlorophytum*, the flowering period of an inflorescence lasts a long time as the flowers open consecutively. It is the only inflorescence produced on that shoot. Beside it a new shoot will develop from a lateral bud of the rhizome.

**Flowers:** These are very similar in structure; the perianth being white, dark keeled, delicate in texture with the watery cells translucent as in *Chlorophytum*. The stamens are often declinate. The filaments are smooth, or in some species rough in the upper part. The anthers are large and basifixed, with the filament tip inserted in a rimmed pit at the base of the anther. When the anthers fade they curl backwards in a spiral. Often the margins of the open locules are wavy. The ovary is oblong or ovoid with 8-24 biseriate, axillary ovules in each loculus. It was seen that in some



specimens one or both rows of ovules would double themselves—the basic number of 16 becoming thus 24 or even 32. The funicle is slender and short.

**Capsule:** In the distichous species (and also in *A. krauseanum*) the capsule is oblong, with many transverse ridges (the number of ridges corresponding roughly with the number of ovules). In the other species it is ovoid and apiculate or beaked and the transverse ridges may be absent.

**Seed:** It is small and angular with a black and granular testa. During development inside the rounded capsule the globular, young seeds are pressed into irregular, angular shapes.

#### KEY TO SPECIES

- Leaves distichous, ca. 8; scape usually naked seldom bracteate, often compressed, sometimes narrowly winged; capsule rounded, obtuse, rarely apiculate, with transverse ridges; flowers usually clustered:
- Robust plants up to 180 cm high (usually smaller); leaf margin often raised; roots woody, sturdy; pedicels articulated near the base; filaments smooth, shorter than anthers:
- Flowers in a divaricately branched raceme (simple in small or starved plants); floral bracts small, usually dark, firm; style not exerted from closed flower..... 1. *A. angulicaule*
- Flowers in dense fascicles supported by long basal bracts; floral bracts membranous, whitish, large; style exerted from closed flower..... 2. *A. cyperaceum*
- Smaller, more slender plants, 10–50 cm high; leaf margin not raised; roots wiry, numerous, with scattered tubers; pedicels articulated near the base or the middle; filaments smooth or rough in upper half, more or less equalling anthers in length:
- Leaves linear, not over 2 cm wide, usually much narrower:
- Filaments smooth (occasionally rough in *A. cooperi*):
- Raceme divaricate with bare wiry branches and the axils congested with subulate bracts many flower buds and an occasional, accessory branch; scape slender, subterete, not winged, naked..... 3. *A. galpinii*
- Raceme more or less spicate, occasionally with a basal ascending branch; pedicels short, flowers closely arranged on rhachis; bracts enclosing the buds; scape flat, winged, stout, naked or with some sterile bracts near spike..... 4. *A. anceps*
- Raceme congested in a pseudo-capitate inflorescence, always simple, rarely somewhat elongated; bracts membranous, usually whitish and large, occasionally small; scape flat, fairly stout, naked; filaments smooth, occasionally rough..... 5. *A. cooperi*
- Filaments rough:
- Raceme divaricately branched, flowers often congested at first; ovules ca. 10; leaves flaccid; gregarious plants, found in the lower parts of Natal..... 6. *A. saundersiae*
- Raceme seldom divaricately branched, usually spicate, or with many interrupted spikes on rhachis; ovules ca. 14; plants variable, found on the highveld of the Transvaal and Orange Free State to South West Africa..... 7. *A. fasciculatum*
- Leaves lanceolate-ovate, over 2 cm wide, plants densely and shortly hairy:
- Leaf not "petioled"; filaments scabrid; Pretoria and surrounding districts 8. *A. trichophlebium*
- Leaf "petioled"; filaments smooth; northern South West Africa, Southern Rhodesia to Nyasaland..... 9. *A. whytei*
- Leaves rosulate, many (subdistichous in *A. acutum*) scape terete, bracteate; capsule ovoid (cylindrical in *A. acutum*) beaked or apiculate, smooth or with some transverse ridges; flowers single or 1–3-nate:
- Plants grasslike, xerophytic:
- Roots wiry, numerous, with scattered tubers:
- Capsule ovoid, beaked, glabrous; leaf margin not thickened; filaments smooth; southern South West Africa, south-western Cape..... 10. *A. rangei*
- Capsule small, globose, obtuse or apiculate, with transverse ridges; leaf margin thickened; flowers very small, pedicels filiform; filaments rough; northern South West Africa..... 11. *A. krauseanum*
- Roots swollen, cylindrical; capsule smooth, acute; Angola, northern South West Africa, Southern Rhodesia, Transvaal..... 12. *A. calyptrocarpum*
- Plants not grasslike (if with linear leaves then flowers solitary with an inner two-keeled bracteole):
- Leaves sub-distichous; flowers 1–3-nate on simple or sub-simple racemes, congested at first elongating during anthesis; capsule cylindrical, apiculate..... 13. *A. acutum*
- Leaves rosulate, numerous; flowers single with an ovate outer bract and a two-keeled inner bracteole; inflorescence branched or simple; capsule beaked:
- Inflorescence divaricately branched (simple in young plants); bracts small:
- Scape glabrous..... 14. *A. longistylum*
- Scape scabrid..... 15. *A. radula*
- Inflorescence simple, seldom with a basal, ascending branch; bracts large:
- Leaves hairy; inner bracteole with two horns..... 16. *A. transvaalense*
- Leaves glabrous; inner bracteole oblique with one horn..... 17. *A. haygarthii*



1. *A. angulicaule* Bak. in J. Linn. Soc. 15 : 305 (1876) and in Fl. Cap. 6 : 382 (1896). Type: Cape, Keiskamma, *Hutton* (K, lecto!, PRE, photo.).  
*A. robustum* Bak. in Fl. Cap. 6 : 386 (1897). Type: Zululand, *Wood* 3972 (K, holo., NH. iso!, PRE, photo.). *A. multisetosum* Bak. in Fl. Cap. 6 : 386 (1897). Type: Swaziland, *Galpin* 1013 (K, holo., PRE, iso!). *A. rubrovittatum* Poelln. in Bol. Soc. Brot. 16, 2 : 49 (1942). Type: Transvaal, Barberton, *Galpin* 539 (B, holo!, PRE, GRA, iso!).

Plants variable in size, 20–150 cm high. *Roots* hard, woody, fairly stout, ca. 3 mm in diam. *Rhizome* with irregular woody knobs, horizontal, covered with fibres from old leaf bases. *Leaves* linear to linear-lanceolate, up to 75 cm long and 2.5 cm broad, coriaceous, ribbed, clasping at the base, tapering in upper half, apex acuminate, margin raised or flat; lamina glabrous, seldom minutely horizontally pubescent on the prominent ribs above (glabrous to the naked eye). *Inflorescence* branched (simple in starved plants); scape flattened, often narrowly winged, occasionally bracteate, rachis often zigzagging between axils; bracts small ca. 3 mm long, deltoid, dark, apiculate, clustered; pedicels articulated near the base, up to 1 cm long in fruit, angular. *Flowers* 3–4-nate, white with dark keeled perianth segments ca. 1 cm long; tips ciliate, 3 outer often with dark tips; filaments glabrous, short; anthers large; ovary with ca. 16 ovules per cell. *Capsule* 6 mm long. *Seeds* typical.

Flowering Period: From June onwards through the summer.

DISTRIBUTION: Eastern Cape, Natal, Orange Free State, Transvaal, Bechuanaland, Swaziland, Portuguese East Africa. Usually found on grassy mountain slopes.

CAPE.—Peddie: Keiskamma River Mouth, edge of lagoon, *Galpin* 7652 (PRE). [In the Fl. Cap. 6 : 382 Baker quotes *Zeyher*, from Zwartkops River, but this is probably *Chlorophytum capense* (L.) Voss].

NATAL.—Pinetown: *Galpin* 12097 (PRE); Nkandhla: Qudeni, *Gerstner* 634 (PRE).

SWAZILAND.—Havelock Mine, *Miller* 2999 (PRE).

TRANSSAAL.—Lydenburg: Kemp's Heights near Lydenburg, *Marais* 14 (PRE). Barberton: Saddleback Mountain slopes, *Galpin* 539 (PRE). Belfast: Waterval Onder, *Young* 1465 (PRE). Waterberg: farm Roodepoort No. 15, Palala Road, *Galpin* 11611 (PRE). Potchefstroom: Losberg, *Theron* 800 (PRE).

ORANGE FREE STATE.—Kroonstad: Bothaville, *Goossens* 1206 (PRE).

BECHUANALAND.—Taungs, *Brueckner* 591 (PRE).

PORTUGUESE EAST AFRICA.—Mocuba, *Faulkner* 242 (PRE).

*A. angulicaule* varies a good deal in size. It grows in grassveld which is regularly ravaged by fires. Of the synonyms, *A. robustum* seems to be its optimal form and *A. multisetosum* the small stunted form appearing early in spring after cold, drought and fires; *A. rubrovittatum* is intermediate. The type from the eastern Cape has no prominent leaf margin but this I consider to be merely a variation. The raised margin results from the fusion of the two outer ribs. The specimens from the western Free State and western Transvaal are more slender in habit. All the above specimens have the same essential characters; the hard, woody roots, knobby rhizome, flattened scape, small dark bracts, pedicels articulated near the base and very short filaments.

## 2. *A. cyperaceum* Kies sp. nov. distincta.

*Radices* crassae lignosae. *Folia* linearia conduplicata rigida glabra 80 cm longa, 6–12 mm lata, marginibus prominentibus. *Scapae* teres rectus costatus, 45–180 cm longus. *Flores* axillares fasciculati congesti. *Bractae* inferiores 15 cm longae foliosae superiores 5 mm longae membranaceae basi rubrae brunneae carinatae marginibus laceratae. *Pedicelli* 15 mm longi, prope basin articulati. *Perianthium* 1 cm diam. *Filamenta* laevia, antheris breviora; stylus longe exsertus. *Capsula* ovoidea apice acute transverse rugosa.

Hard, glabrous, rush-like plants up to 180 cm tall. *Roots* hard, woody, fairly stout, 2 mm in diam. spreading. *Rhizome* with knobs, woody, horizontal, covered with fibres from old leaf bases. *Leaves* erect, linear, up to 80 cm long, ca. 14 mm broad, folded, glabrous, ribbed, hard, clasping at the base, long acuminate in upper half, margin raised, yellow. *Inflorescence* with flowers massed in 3-4 dense clusters at the apex, supported by a long, patent, basal bract; scape round, compressed, up to 180 cm tall, hard; lower basal bract leaf-like, long acuminate, patent, up to 17 cm long; floral bracts ovate, 8 mm long, white, thin; pedicels patent, articulated near the base, elongating during anthesis, up to 15 mm long in fruit. *Flowers* in several dense clusters; perianth segments ca. 14 mm long, tips of outer segments dark on outside; filaments glabrous, short; anthers large, longer than filaments; style declinate, crook-shaped, ultimately longer than perianth; ovary with ca. 10 ovules per loculus. *Capsule* oblong, 1 cm long, transversely rugose, apiculate. *Seeds* typical.

Flowering Period: February-March.

**DISTRIBUTION:** Transvaal, collected in the Waterberg, Middelburg and Lydenburg districts; ("in mixed open bushveld on hillside" *Story*).

**TRANSVAAL.**—Lydenburg: near Steelpoort, *Story* 4071 (PRE). Middelburg: Zoetevelden, *van der Merwe*, 1306 (PRE). Waterberg: *Fole Evans* in PRE 28768 (PRE, holo.).

A very distinct and conspicuous species, nearest *A. angulicaule* Bak. The congested inflorescence subtended by large, boatshaped bracts, separates it from all the other species.

### 3. *A. galpinii* Bak. Fl. Cap. 6: 385 (1897); aggregate species.

Glabrous or hairy plants up to 75 cm high. *Roots* many, thin, wiry with scattered tubers near the root-tips. *Rhizome* small, horizontal, sometimes covered with fibres from old leaf bases. *Leaves* distichous, about 8 per shoot, primary small, the following becoming progressively larger, linear to linear-lanceolate, 6-60 cm long, 2-10 mm broad, soft or firm, closely ribbed, glabrous or shortly, patently setose on the ribs especially on the primary leaves, the margin fimbriate or glabrous, base somewhat dilated, clasping. *Inflorescence* a divaricately branched raceme with patent, bare side branches emerging from the axillary flower fascicles, rarely simple in starved or young plants; scape terete or flattened and narrowly winged, ribbed; lower axillary bracts often with a long, soft awn, up to 3 cm long; floral bracts small, usually dark, apiculate; pedicels up to 1 cm in fruit, articulated below the middle. *Flowers* with perianth variable in size, segments 10-15 mm long; stamens declinate, 4 situated posteriorly, 2 anteriorly with the style; filaments smooth; ovary oblong with 10-30 ovules per cell. *Capsule* rounded, ca. 6 mm high, closely transversely ribbed. *Seeds* typical.

Flowering Period: November-March.

**DISTRIBUTION:** Warmer parts of the Transvaal, Southern Rhodesia to northern South West Africa and Angola; also in Portuguese East Africa. Usually in grassland or along river courses in sand.

### KEY TO VARIETIES

- Primary leaves short, hairy, later leaves glabrous; bracts aristate; plants wiry; in grassveld  
a. var. *galpinii*
- Leaves glabrous, coriaceous; bracts small, apiculate; usually along river courses, in sand  
b. var. *matabelense*
- Leaves soft, margin fimbriate with red or white cilia up to 2 mm long; on rocky grass slopes  
c. var. *norlindii*

#### (a) var. *galpinii*

*A. galpinii* Bak. in Fl. Cap. 6: 385 (1897). Type: Transvaal, Barberton, *Galpin* 1160 (K, holo., PRE, NH, iso!).

*A. patulum* Bak. in Fl. Cap. 6 : 386 (1897). Type: Transvaal, Barberton, Saddleback Mountain, *Galpin* 1232 (K, holo., PRE, GRA, iso!). *A. rehmannii* Bak. in Bull. Herb. Boiss. Ser. 2 : 8 : 781 (1901). Type: Transvaal, Potgietersrus, Klippan, *Rehmann* 5432 (Z, holo!, PRE, photo.). *A. divaricatum* Bak. ex Schinz in Viert. Nat. Ges. Zür. 49 : 174 (1904), non Jacq. Type: Transvaal, Pietersburg, Shilouvane, *Junod* 665 (Z, holo! PRE, photo.). *A. bakerianum* Poelln., in Fedde, Rep. 50 : 232 (1941) nom. nov. for *A. divaricatum* Bak. ex Schinz. *A. junodii* Bak. in Viert. Nat. Ges. Zür. 49 : 175 (1904). Type: Transvaal, Pietersburg, Shilouvane, *Junod* 1735 (G, holo!, PRE, photo.). *A. delagoense* Poelln. in Fedde, Rep. 53, 6 : 134 (1944). Type: Portuguese East Africa, Lourenço Marques, *Schlechter* 11709 (B, holo., probably destroyed, PRE, iso!). Fig. 1.

Flowering Period: October–April.

DISTRIBUTION: Transvaal, Portuguese East Africa and Southern Rhodesia, grassveld.

TRANSVAAL.—Barberton: *Thornicroft* 24 (PRE). Nelspruit: Pretorius Kop, *van der Schyff* 1106 (PRE). Pilgrims Rest: Calais, *Killick & Strey* 2556 (PRE). Pietersburg: between Duiwelskloof and Munnik, *Schweickerdt* 1038 (PRE). Sibasa: Kruger National Park, Baiandbai, *Lang* (TM 32158, 32149, PRE). Waterberg: near Vaalwater, *Meeuse & Strey* 10424 (PRE).

PORTUGUESE EAST AFRICA.—Delagoa Bay, *Forbes* (B). Lourenço Marques, Sul do Save, between Boane and Gova, *Myre & Carvalho*, 1367 (PRE).

SOUTHERN RHODESIA.—Matobo, *West* 2443 (SRGH). Bulawayo, *Feiertag* (SRGH).

The variety *galpinii* is a xerophytic form, fairly uniform in appearance and is common around Barberton, the type locality, and elsewhere in the Lowveld. *A. patulum* also from Barberton, must have been collected in more shady, moist surroundings. It is glabrous and has few-flowered fascicles but no good differences could be detected. It agrees with specimens collected in Southern Rhodesia found near rivers.

(b) var. *matabelense* (Bak.) Oberm., stat. nov.

*A. matabelense* Bak. in Fl. Trop. Afr. 7 : 484 (1898). Type: Southern Rhodesia, Matabeleland, banks of the Matengwe River, *Holub* (K, holo.). *A. volkii* Soelch, in Mitt. Bot. Staatssamm. München II: 186 (1956). Type: South West Africa, Grootfontein, Blockfontein on dunes, *Volk* 1685 (M, holo., PRE, photo.).

Flowering Period: January–May.

DISTRIBUTION.—Angola, South West Africa, Southern and Northern Rhodesia, Transvaal.

ANGOLA.—Between Kembo and Kutile Rivers, *Pocock* 457 (PRE).

SOUTH WEST AFRICA.—Okavango Native Territory: Omuramba Khaudum, North of Tamso, *de Winter & Marais* 4735 (PRE, K).

NORTHERN RHODESIA.—Mkushi, Fiwila, *Robinson* 2574 (SRGH).

SOUTHERN RHODESIA.—Matoba, farm Besna kobila, *Miller* 1941, 2523 (SRGH); Enterprize, *Wild* 3698, 3232 (SRGH); Bikita, Devuli Bridge near Birchenough Bridge, *Obermeyer* 2482 (PRE).

TRANSVAAL.—Soutpansberg: Dongola Reserve, Sandveld, *Pole Evans* 4586 (PRE, SRGH); 4307 (PRE); Pretoria: Hammanskraal, *Codd* 5622; 3468 (PRE).

(c) var. *norlindii* (Weim.) Oberm., stat. et comb. nov.

*Chlorophytum norlindii* Weim. in Bot. Not. 1937, 434, photo., p. 435. Type: Southern Rhodesia, Makoni, near Maidstone, *Norlindh & Weinarcik* 4128 (LD, holo., PRE, SRGH, iso!).

Flowering Period: January–March.

DISTRIBUTION: Southern Rhodesia, Transvaal.



FIG. 1.—*Anthericum galpinii* Bak. a, habit showing distichous leaves and tuberous root swellings,  $\times \frac{1}{2}$ . b, capsule,  $\times \frac{1}{2}$ . c, stamen,  $\times 2$ . d, seed,  $\times 6$ .



SOUTHERN RHODESIA.—Umtali, Quagga's Hoek, *Chase* 4874 (SRGH, PRE). Inyanga, *Chase* 559 (PRE). Salisbury: *Brain* 8327 (SRGH); Hunyani, *Eyles* 4613 (SRGH); Makabusi, *Wild* 2275 (SRGH); Marandellas, *Dehn* 34 (SRGH). Urungwe: near Msukwe River, *Davies* (SRGH 67829).

TRANSVAAL.—Waterberg: Visgat (near Dorset) near Vaalwater, *Meeuse* 10565 a (PRE).

*A. limosum* Bak. in Trans. Linn. Soc. ser. 2, Bot. 1: 257 (1878) from Angola, Barro do Bengo, in swampy ground, *Welwitsch* 3803, 3804 (BM, holo.?) may be this species but as I have neither seen the type nor any other material from that region, I hesitate to sink *A. galpinii* and its varieties under this species. The type at BM (PRE, photo.) does not agree with Baker's description.

4. *A. anceps* Bak. in J. Linn. Soc. 15: 305 (1876); Fl. Cap. 6: 382 (1896); Fl. Trop. Afr. 7: 482 (1898). Type: Southern Rhodesia, South African Gold Fields, *Baines* s.n. (K, holo.).

*A. rautanenii* Schinz in Bull. Herb. Boiss. Ser. 2, 8: 625 (1908); Poelln. in Fedde, Rep. 52: 260 (1943). Type: South West Africa, Amboland, Olukonda, *Rautanen* 603 (Z, holo., Pre, photo.). *A. otavense* Engl. & Krause in Engl. Bot. Jahrb. 45: 129 (1911); Poelln. in Fedde, Rep. 52: 260 (1943). Type: South West Africa, Otavi, *Dinter* 622 (B, holo., probably destroyed: NBG, iso., PRE, photo.).

Plants up to 40 cm high, solitary or gregarious. *Roots* many, thin, spreading, occasionally with tubers near the tips. *Rhizome* small, horizontal, knobby, covered with fibres from old leaf-bases. *Leaves* linear, up to 40 cm long, 1 cm broad, not much attenuated until near the apex, base clasping, slightly dilated, folded, glabrous, ribbed. *Infflorescence* a simple dense and closely flowered raceme, occasionally with a short, ascending basal branch which may be sterile; about as long as the leaves; scape stout, flattened, narrowly winged; lower sterile bracts clasping scape, upper floral bracts ascending with a patent, soft awn, glumaceous, up to 2 cm long, nerved; pedicels short, hidden by the bracts, up to 6 mm long in fruit, articulated below the middle. *Flowers* many in each axillary fascicle, the lowest "fascicle" sometimes elongating to form a short distichous-flowered side branch; perianth white, with the segments 11 mm long, the outer with dark tips; filaments glabrous, short; anthers typical; ovary with ca. 12 ovules per cell. *Capsule* globose, 7 mm in diam., closely, transversely ribbed. *Seeds* typical.

Flowering Period: October–March.

DISTRIBUTION: Southern Rhodesia, northern South West Africa, apparently in sandy mopani grassveld.

SOUTHERN RHODESIA.—Bulawayo, *Eyles & Johnston* 1180 (GRA). Wankie, *Levy*, 38 (PRE). Plumtree, *McLeod* 6 (PRE).

SOUTH WEST AFRICA.—Grootfontein: Otavi Valley, *Dinter* 5509 (B); Arisotavi, *Boss* (TM 35683, PRE); Gautscha Pan, *Maguire* 21966 (PRE); Rotenfels, *Rehm* (M). Outjo: Feigenwasser, *Volk* 1795 (M, PRE). Okavango Native Territory: near Nzinzi, *de Winter* 3997 (PRE).

5. *A. saundersiae* Bak. in Fl. Cap. 6: 384 (1896). Type: Natal, *Saunders* (K, holo.).

*A. pulchellum* Bak. in J. Bot. Lond. 1872: 140 nom. nud.; Fl. Cap. 6: 386 (1897). Type: Natal, Durban, *Gerrard* 554 (K, holo.). *A. rudatisii* Poelln. in Fedde, Rep. 53: 129 (1944). Type: Natal, Umzinto, Ifafa, *Rudatis* 1235 (B, holo., PRE, photo.). var. *angustum* Poelln. l.c. Type of var.: Natal, Marianhill, collector unknown (B, holo., probably destroyed).

Plants up to 40 cm high, gregarious. *Roots* thin, long (no tubers seen). *Rhizome* creeping, small, knobby, covered with sparse, short fibres from old leaf bases. *Leaves*

erect, linear, up to 30 cm long, 1 cm broad, gradually tapered to the subulate apex, clasping at the base, soft, usually flat. *Inflorescence* a branched or sub-simple, contracted and congested raceme with the lowest branch often patent; scape flat, winged, bare; lowest bract much longer than the following ones, leaflike; floral bracts small, 8 mm ovate, subulate, dark; pedicels up to 8 mm long, articulated near the base. *Flowers* very many in each axillary fascicle; perianth with segments 1 cm long; filaments minutely papillate in upper part, slightly longer than anthers; ovary with 7–10 ovules per cell; style declinate. *Capsule* globose, 6 mm in diam. with lax, transverse ridges. *Seeds* typical.

Flowering Period: October–March.

DISTRIBUTION: Natal, usually in low grasslands near river mouths which become inundated at times.

NATAL.—Port St. Johns: West Gate, *Galpin* 3404 (PRE); *Schonland* 4200 (GRA) Port Shepstone: Port Edward, *Moss* 19177 (J). Umzinto: Scottburgh, *Mauve* 4013 (PRE, G); Umlazi: Isipingo, *Salter* 381/34 (BOL). Durban: Westville, *Johnston* (NH 20172); Berea, *Forbes* 479 (NH). Hlabisa: *Ward* 1929; Hluhluwe Game Reserve, *Ward* 2806 (NH).

In the Fl. Cap. 6: 387 (1897), Baker cites *Nelson* 185 from the Vaal River, near rapids, as this species. Although the specimen is poor, it is recognizable as *A. fasciculatum*, the type of which was collected in the same area.

6. *A. cooperi* Bak. in J. Linn. Soc. 15: 304 (1876); Fl. Cap. 6: 382 (1896). Type: Natal, *Cooper* 1004 (K, syn.); Basutoland, *Cooper* 3302 (K, syn.). *A. pachyphyllum* Bak. in J. Linn. Soc. 15: 304 (1876); Fl. Cap. 6: 381 (1896). Type: Cape, Grahamstown, collector unknown (K, holo., PRE, photo.). *A. triflorum* var. *minor* Bak. in Fl. Cap. 6: 383, pro parte, as to *Galpin* 1025 (PRE, GRA) from Barberton. *A. nudicaule* Bak. in Fl. Cap. 6: 384 (1896). Type: Griqualand East, *Tyson* 1054 (K, holo, PRE, iso.). *A. capitatum* Bak. in Fl. Cap. 6: 384 (1896). Type: Natal, Van Reenen's Pass, *Wood* 4795 (K. holo., NH, iso.). *A. adscendens* Poelln. in Bol. Soc. Brot. 16, 2: 70 (1942). Type: Lydenburg, *Wilms* 1503 (B, holo., PRE, photo.). *A. pascuorum* Poelln. in Bol. Soc. Brct. 16, 2: 46 (1942). Type: Natal, *Rudatis* 456 (B, holo., PRE, photo.).

Small plants 10–40 cm high, usually gregarious. *Roots* thin, many, producing some scattered tubers near the tips. *Rhizome* horizontal, knobby, woody, covered with fibres from old leaf bases. *Leaves* erect or falcate, linear to lanceolate, variable in length, 5–30 cm long, 3–10 mm broad, attenuated near the obtuse, apiculate apex, clasping at the base, flat or usually folded, glabrous or minutely pubescent on the prominent ribs and margin with minute, horizontal hairs or minutely ciliate. *Inflorescence* a simple raceme, usually congested near the apex; scape compressed, narrowly winged, usually naked, bracts variable, small or large, green or white and membranous; pedicels short, up to 8 mm in fruit, articulated below the middle. *Flowers* 1–3-nate, congested or occasionally somewhat lax, with the rhachis visible between the flower fascicles; perianth with segments 8–12 mm long; filaments smooth or papillate in upper half, longer than anthers; ovary with ca. 16–24–32 ovules per cell (one or both rows may sometimes double the number of ovules usually produced). *Capsule* globose, 8 mm in diam., with many transverse ridges. *Seeds* typical.

Flowering Period: October–March.

DISTRIBUTION: Eastern Cape, Natal, eastern Free State, Transvaal; in grassveld.

The size of the bracts varies from small and green to large, white and membranous; the type (form a) according to the description, has the large bracts, a common form in the Drakensberg area. It is very similar in appearance to *A. capitatum* which Baker separated because of the papillate (not smooth) filaments. I suspect that this variation in the filaments may be the result of hybridization, possibly with *A. saundersiae*. The

Transvaal and eastern Cape specimens show a form with small, green bracts, somewhat more lax inflorescence and fairly short, falcate leaves (form b). This form agrees with *A. pachyphyllum* Bak. It was not practicable however, to maintain these forms as separate species.

(a) Typical form with large, white, membranous bracts and a congested inflorescence; filaments smooth or papillate.

NATAL.—Klip Rivier: near van Reenen, *Wood* 6158, 12098 (PRE). Alfred: near Umzimkulu, *Killick & Marais* 2010 (PRE). Utrecht: Kaffir Drift, *Thode* A367 (PRE). SWAZILAND.—*Stewart* (TM 10122, PRE).

TRANSSVAAL.—Carolina: *Galpin* 12516 (PRE). Middelburg: Dullstroom, *Noomé* (TM 20800, PRE). Belfast: *Codd* 5632 (PRE); Pilgrims Rest: Graskop, *Galpin* 14530 (PRE).

(b) Form with small greenish bracts, a lax raceme and leaves usually fairly short, falcate (*A. pachyphyllum* Bak.).

CAPE.—Albany: Rockcliffe near Sidbury, *Daly* 816 (PRE); Alexandria: Bushman's River Bridge, on Port Elizabeth Road, *Archibald* 4015 (PRE); Idutywa, *Galpin* 10923 (PRE).

TRANSSVAAL.—Potchefstroom: *Burt Davy* 1062 (PRE). Pretoria: hills, *Leendertz* 473 (PRE). Benoni: *Bradfield* 291 (PRE). Johannesburg: Witpoortjie, *Gilmore* 663 (PRE). Waterberg: near Nylstroom, *Burt Davy* 2072 (PRE).

7. *A. fasciculatum* Bak. in J. Linn. Soc. 15: 316 (1876); Fl. Cap. 6: 383 (1896). Type: Vaal River Plains, *Barber* (K, holo.).

*A. subulatum* Bak. in Bull. Herb. Boiss. Ser. 2, 1: 781 (1901). Type: Transvaal, Pretoria, Donkerhoek. *Rehmann* 6550 (Z, holo.!, PRE, photo.). *A. hereroense* Schinz in Bull. Herb. Boiss. Ser. 2, 1: 857 (1901); Poelln. in Fedde, Rep. 52: 237 (1943). Type: South West Africa, Hereroland, Orumbo, *Dinter* 1306 (Z, holo.!, PRE, photo.). var. *longibracteatum* Poelln., l.c. Type of var.: Aitzas, *Dinter* 823 (B, holo.?). *A. conrathii* Bak. in Bull. Herb. Boiss. Ser. 2, 4: 997 (1904). Type: Transvaal, Germiston, Modderfontein, *Conrath* 731 (GZU, holo.!, PRE, photo.). *A. lydenburgense* Poelln. in Bol. Soc. Brot. 15, 2: 73 (1942). Type: Transvaal, Lydenburg, *Wilms* 1538 (B, holo.!, PRE, photo.). *A. wilmsii* Diels ex Poelln. in Fedde, Rep. 53: 131 (1944). Type: Transvaal, Lydenburg, *Wilms* 1502 (B, holo. ! L, iso., PRE, photo.). *A. wilmsii* Diels ex Burt Davy and Pott-Leendertz in a First Check list of the Flowering Plants and Ferns of the Transvaal and Swaziland, Ann. Transv. Mus. 3: 134 (1912) nom. nud.

Plants up to 60 cm high, gregarious or solitary. *Roots* many, thin, spreading, with some tubers near the tips. *Rhizome* horizontal, woody, knobby, covered with fibres from old leaf bases. *Leaves* linear to filiform, 5–40 cm long and 1–5 mm broad, flat or usually folded, soft or coriaceous, ribbed, glabrous or with short, stiff hairs, on the ribs; base vaginate, dilated and with a ciliate margin; outer leaves very small. *Inflorescence* a simple raceme or with some divaricate basal branches or an interrupted, spike-like, branched inflorescence, overtopping the leaves; scape terete, seldom compressed, often ribbed, lowest bract slightly larger than the upper floral bracts, glumaceous, subulate, closely folded, amplexicaul, varying in length from 6–12 mm, ribbed, light or dark; pedicel up to 1 cm in fruit, articulated below the middle. *Flowers* congested or laxly arranged, perianth with segments ca. 14 mm long; filaments rough in upper half; ovary with ca. 14 ovules per cell. *Capsule* oblong, 9 mm. *Seeds* typical.

Flowering Period: October–March.

DISTRIBUTION: Eastern and south-western Transvaal, Bechuanaland, South West Africa, Orange Free State, northern Cape, Basutoland; a common grassveld species.

Apparently a variable, adaptable species with a wide distribution. The following forms were distinguished but it was not possible to maintain them as distinct varieties.



(a) Typical form. Found near the Vaal River from Vereeniging to Barkly West, apparently in moist surroundings. It is a soft leaved, gregarious species with usually a simple inflorescence and small, soft, whitish bracts.

TRANSVAAL.—Benoni: Benoni, in water or on its edge, *Bradfield* 349 (PRE).

ORANGE FREE STATE.—Fauresmith, *Kies* 334 (PRE). Boshoff: Smitskraal, *Burt Davy* (PRE, 12904b).

CAPE.—Kimberley: sandveld near Riverton, *Acocks* 2260 (PRE). Barkly West: Schietpan Kalk, *Acocks* 1645 (PRE). Vryburg: Armoedsvlakte, *Mogg* 8023 (PRE).

(b) Highveld form. Probably as a result of drought and cold the plants remain small and bear few flowers. They equal *A. subulatum* Bak. and *A. conrathii* Bak. the types of which were collected near Johannesburg.

TRANSVAAL.—Heidelberg: *Leendertz* (TM 4687, PRE). Middelburg: *Jenkins* (TM 10181, PRE). Wakkerstroom: near Volksrust, *Schweickerdt* 621 (PRE).

SWAZILAND.—Mbabane: Ukutula, *Compton* 25252; near Mbabane, *Compton* 27548 (PRE).

(c) Bushveld form. Solitary, large, coriaceous plants with compound, interrupted, spike-like inflorescences; it is found in the warmer parts of the Pretoria district to Lydenburg. It is extremely common in grassveld. Often recorded from limestone areas. They equal *A. lydenburgensis* Poelln. and *A. wilmsii* Poelln.

TRANSVAAL.—Benoni: *Bradfield* 350 (PRE). Pretoria: University Farm, Pretoria, *Kies* 364 (PRE); near Delmas, *Codd*, (PRE). Johannesburg: Milner Park, *Moss* 6040 (PRE J.).

(d) Western form. Gregarious, leaves narrow, shortly pubescent; flowers evenly spaced on a simple rhachis. This equals *A. hereroensis* Schinz.

SOUTH WEST AFRICA.—Grootfontein: *Rehm* (M), *Schoenfelder* S 432 (PRE). Otjiwarongo: *Volk* 463 (M). Gibeon: *Asis*, *Volk* 721 (M).

CAPE.—Mafeking, *Brueckner* 553 (PRE), *Leistner* 580 (PRE).

(e) Crisped form. Gregarious, leaves soft, fairly broad, margin often crisped, ciliate; inflorescence often divaricately branched.

CAPE.—Mafeking: *Acocks* 18778 (PRE); near Setlagoli. Kalahari Thornveld, *Leistner* 567 (PRE). Vryburg: Armoedsvlakte, *Sharpe* (PRE 7399), *Foley* (PRE 2760). Herbert: Campbell, *Acocks* 1421 (PRE).

TRANSVAAL.—Christiana: Kameelpan, *Theron* 433 (PRE), 612 (PRE); "Kaffaria" near Christiana, *Burt Davy* (PRE, 12774). Pretoria: near Pienaar's River Station, *Codd* 6222 (PRE).

8. *A. trichophlebium* Bak. in Fl. Cap. 6: 382 (1896). Type: Transvaal, Pretoria, hills above Apies River, *Rehmann* 4314 (K, holo.).

*A. pretoriense* Bak. in Bull. Herb. Boiss. Ser. 2, 1: 780 (1901). Type: Transvaal, Pretoria, hills above Apies River, *Rehmann* 4314 (Z holo. ! PRE, photo).

*A. vaginatum* Bak. in Bull. Herb. Boiss. II, 4: 997 (1904). Type: Transvaal, Irene, *Conrath* 1243 (GZU, holo ! PRE, photo.). In the publication no number is mentioned but on the type sheet this is given as 1243.

Small, pubescent plants up to 20 cm high. *Roots* many, hard, wiry, 1–2 mm in diam. *Rhizome* woody, horizontal, covered with fibres from persistent leaf bases. *Leaves* ca. 8, distichous, primary small, ovate, becoming progressively larger and ovate-lanceolate to oblong-oblancoate, ca. 11 cm long, 3.5 cm wide, acute at the apex, narrowing towards the clasping base, lamina firm, ribbed, setose with white patent, velvet hairs. *Inflorescence* a simple, congested, many flowered raceme, rarely with a short basal side-branch; scape flattened, sturdy, ribbed, pubescent, 10–20 cm long; bracts lanceolate-acuminate, up to 3 cm long; pedicels articulated below the



middle, up to 8 mm in fruit. *Flowers* congested, with the perianth greenish-white, segments ca. 1 cm long; filaments with unequal short papillae in upper half; ovary with ca. 14 ovules per cell. *Capsule* typical, 8 mm long. *Seeds* typical.

Flowering Period: September–March.

DISTRIBUTION: Transvaal; found in the Pretoria, Johannesburg, Rustenburg and Waterberg districts, in grassveld, not very common.

TRANSVAAL.—Pretoria: *Mogg* 16323A (PRE); Meintjies Kop, *Leendertz* 912 (PRE). Johannesburg: Bryanston, *Gilliland* (J 28093, PRE). Rustenburg: Swartruggens, *Sutton* 793 (PRE). Waterberg: near Nylstroom, *Häfstrom & Acocks* 207 (PRE).

9. *A. whytei* Bak. in Fl. Trop. Afr. 7: 493 (1898). Type: Nyasaland, Mount Zomba, *Whyte* (K, holo.).

*A. friesii* Weimarck in Bot. Not. Lund 1937: 422, photo, p. 423. Type: Southern Rhodesia, Inyanga near Cheshire, *Norlindh & Weimarck*, 4330 (LD, holo., PRE, SRGH, iso.).

Plants up to 1 m high. *Roots* many, thin. *Rhizome* small, creeping, covered with fibres from old leaf bases. *Leaves* about 8, becoming progressively larger, the largest pair with a lanceolate lamina, 30 cm long, 3.5 cm broad, tapering to an acute apex and narrowing at the base into a long “petiole” up to 18 cm long, closely ribbed with the raised ribs densely and minutely pubescent, margin narrow, yellow. *Inflorescence* a simple, congested raceme, seldom with 1–2, short, basal ascending branches; scape flattened, narrowly winged, glabrous, but for the ciliate wings, often with a small, sterile, adpressed bract near the apex; fertile bracts small, ovate, acute, up to 8 mm long, membranous; pedicels up to 1 cm in fruit, articulated below the middle. *Flowers* congested with the white perianth segments 12 mm long, the apex of the outer segments dark and papillate; filaments glabrous, 4 mm; anthers 10 mm; ovary with ca. 18–24 ovules per cell; style ultimately longer than perianth. *Capsule* typical, closely ribbed. *Seeds* typical.

Flowering Period: November–March.

DISTRIBUTION: Northern South West Africa, Southern and Northern Rhodesia, Portuguese East Africa, Nyasaland. Usually in moist grassland in Mopani woodland. SOUTH WEST AFRICA.—Okavango Native Territory: Okavango River near Masari Camp, *de Winter* 4089 (PRE).

SOUTHERN RHODESIA.—Victoria Falls, *Rogers* 5624 (GRA). Que Que, *McLeod* 30 (PRE). Salisbury, *Brain* 9784 (SRGH).

NORTHERN RHODESIA.—Mazabuka, near Chirundu Bridge, *Drummond* 5410 (SRGH); Mazabuka, *Vet. Officer*, C.R.S. 587 (PRE); Livingstone–Maramba Road, *Young* 1091 (PRE, SRGH).

10. *A. rangei* Engler & Krause in Engl. Bot. Jahrb. 45: 125 (1910); Poelln. in Fedde, Rep. 52: 260 (1943). Type: South West Africa, Diamond area II, Aus, *Range* 157 (B, holo., probably destroyed).

*A. scariosum* Duthie in Ann. Stell. Univ. 4: 15, t5 (1926); Ann. Bol. Herb. 4: 136 (1928). Type: Cape, Stellenbosch, *Duthie* 1818 (STE, holo., J. iso.). *A. tubiferum* Dinter in Fedde, Rep. 29: 263 (1931); Fedde, Rep. App. 23: 57 (1923) nom. nud.; Poelln. in Fedde, Rep. 52: 242 (1943). Type: South West Africa, Klinghardt Mountains, *Dinter* 4001 (B, lecto.!, PRE, iso.!, photo.). *A. rigidifolium* Poelln. in Bol. Soc. Brot. 16, 2: 48 (1942). Type: Cape Town, Claremont, *Schlechter* 524 (B, holo.!, PRE, photo.).

Grasslike, wiry plants up to 40 cm high. *Roots* numerous, wiry, often with many scattered watery tubers. *Rhizome* lateral, thickly covered with fibres from old leaf bases. *Leaves* many, rosulate, erect, straight or spirally curled, linear or filiform 5–20 cm long, 1–2 mm wide, dilated and membranous at the base, glabrous, wiry, margin

mirutely cartilagino-dentate. *Inflorescence* simple or with some ascending branches, laxly flowered; scape terete, bracteate, glabrous; floral bracts fascicled, membranous; pedicels up to 10 mm long in fruit, articulated below the middle. *Flowers* 1-4-nate, perianth spreading, segments ca. 10 mm long; filaments smooth; ovary ovoid with ca. 10 ovules per cell, style glabrous, 6 mm long. *Capsule* ca. 8 mm long, ovoid, beaked, transversely rugose. *Seeds* ca. 2 mm in diam. tetrahedral.

Flowering Period: September-March (in the Cape from January to March. in leaf May-November; those from the southern Namib were in flower in September).

DISTRIBUTION: Southern South West Africa, the south-western Cape to the Cape Peninsula. "In gravelly soil, rare" *Duthie*.

SOUTH WEST AFRICA.—Diamond Area I: Buchu Mountains, Peilberg, on covered dunes, *Dinter* 6506 (B).

CAPE.—Namaqualand: Richtersveld, Kwarass, *Marloth* 12424 (PRE). Calvinia: Lokenburg, *Acocks* 17553 (PRE). Clanwilliam: *Smith* 2617 (PRE). Caledon: Rivier Zordereinde, *Schlechter* 9884 (B, PRE). Hills west of Baths, *Purcell* 57, 58 (NBG). Bredasdorp: between Bredasdorp and Malagas, *Lewis* 3304 (NBG). *Duthie* also cites: Cape, Rondebosch, *Wolley Dod* 2484 (BOL.) and specimens collected by *Guthrie*.

As the type of *A. rangei* was not at Berlin, I had to rely on the description and distribution to identify the species. Specimens collected by *Dinter* near the type locality of *A. rangei* and agreeing with the description, made it reasonably certain that it must have been this species. In their description Engler & Krause give the measurements of the pedicel and the perianth segments as 4 mm. This is much smaller than those of *A. rangei* and near to the small flowers of *A. krauseanum*, but they may have measured immature buds. *A. krauseanum* has not been recorded so far south.

11. ***A. krauseanum*** *Dinter* in Engl. Bot. Jahrb. 48: 354 (1912); Poelln. in Fedde, Rep. 52: 238 (1943). Type: South West Africa, Damaraland, Windhoek, Skaap River, *Dinter* 1913 (B, holo., probably destroyed; NBG, iso., PRE, photo.). *A. rigidum* Krause in Engl. Bot. Jahrb. 48: 353 (1913) e descr.; non Baker (1872); nec de Wild. (1913). *A. rigens* Poelln. in Fedde, Rep. 50: 232 (1941), nom. nov. for *A. rigidum* Krause; Poelln. in Fedde, Rep. 52: 256 (1943). Type: South West Africa, Avas Mountains, *Dinter* 1894 (B, holo., probably destroyed). *A. kyllingoides* Krause in Engl. Bot. Jahrb. 51: 441 (1914); Poelln. in Fedde, Rep. 52: 239 (1943) e descr. Type: South West Africa, Hereroland, Kaistfeld, *Seiner* 661 (B, holo., probably destroyed). *A. brachyphyllum* Suess. in Mitt. Bot. Staatssam. Muenchen, I: 49 (1950). Type: South West Africa, Rehoboth, Buellspoort, *Rehm*, (M, holo., PRE, photo.). *A. durum* Suess. in Mitt. Bot. Staatssam. Muenchen, I: 49 (1950); non Poelln. 1941. *A. suessenguthii* Sölch in Mitt. Bot. Staatssam. Muenchen, II: 176 (1956), nom. nov. for *A. durum* Suess. *A. pungens* Poelln. in Fedde, Rep. 52: 241 (1943) c descr. Type: South West Africa, Hereroland, Brakwater, *Dinter* 1510 (B, holo., probably destroyed).

Plants up to 55 cm, hard, glabrous, grasslike. *Roots* many, thin, 1-2 mm in diam. *Rhizome* horizontal, small, covered with fibres of old leaf bases. *Leaves* stiff, rigid, erect or falcate, flat, linear, 20-30 cm long, 1-3 mm wide, margin and midrib raised. *Inflorescence* a branched, laxly flowered panicle; scape terete, arcuate at the base, bracteate with small bracts; floral bracts minute, fascicled; pedicels filiform, up to 6 mm in fruit, articulated near the base. *Flowers* 1-3-nate, with perianth segments 5 mm long; filaments rough; ovary ovoid. *Capsule* small, 2 mm high, usually broader than long, tipped by the persistent style-base, transversely rugose. *Seeds* typical.

Flowering Period: December-January.

DISTRIBUTION: Known from the northern part of South West Africa, usually in sandy soil.

SOUTH WEST AFRICA.—Windhoek: Khomas Plateau, Friedenau, *Gassner* 209 (M); Voigtland, *Volk* (M 11335); Avas Mountains, farm Kromhock, *Merxmüller*

793 (M). Rehoboth: Gams Mountains, *Merxmüller* 955 (M). Grootfontein: Otavi Mountains, *Rehm* (M); Grootfontein, *Dinter* 806 (NBG); Tsumeb, *Naegelsbach* 66 (M); Auros, *Volk* 5975 (M); *Dinter* 5609 (B). Ovamboland: Rehoboth, *Volk* 2519 (M).

Seiner noted that the Herero name was *ehosuo-tshisumba*, i.e. "make-up grass", as the Hereros grind the roots and then mix it with fat to make an ointment which they rub on their bodies. But in the description of the type plant (*Seiner* 661), Krause describes the roots of *A. kyllingioides* as thin. (*A. kyllingioides* is here considered to be a synonym of *A. krauseanum*). It is possible that this species, like *A. rangei*, mentioned earlier, has tubers near the root tips, but so far these have not been seen on specimens in the herbarium. It is also possible that there is a mistake somewhere. The following species, *A. calyptrocarpum*, with its swollen roots would seem a more likely source for an ointment ingredient.

12. ***A. calyptrocarpum* Bak.** in Trans. Linn. Soc. Ser. 2: Bot. 1, 258 (1878); Fl. Trop. Afr. 7: 480 (1898). Type: Angola, Huilla, between Mampulla and Lopollo, *Welwitsch* 3786 (BM, holo., PRE, photo.).

*A. curvifolium* Krause in Engl. Bot. Jahrb. 48: 354 (1913) e descr.; Poelln. in Fedde, Rep. 52: 258 (1943). Type: South West Africa; Awas Mountains, *Dinter* 1878 (B, holo., probably destroyed). *A. caespitosum* Dinter in Fedde, Rep. 29: 267 (1931); Poelln. in Fedde, Rep. 52: 234 (1943). Type: South West Africa, Grootfontein, Otavi, *Dinter* 5284 (B, holo., PRE, iso.).

Grasslike plants variable in size, 10–60 cm high. *Roots* fairly short, uniform, fleshy, many. *Rhizome* small, horizontal, covered with fibres from old leaf bases. *Leaves* many, filiform, 10–30 cm long base, dilated and membranous, fascicled; pedicels up to 8 mm long in fruit, articulated below the middle. *Flowers* 1–4-nate, with perianth segments rotate; filaments smooth; ovary with ca. 8 ovules per cell. *Capsule* turbinate, 5 mm long, glabrous, smooth, often capped with the withered perianth. *Seeds* typical, 0.75 mm long.

Flowering Period: December–March. Flowers open in the afternoon.

DISTRIBUTION: Angola, Southern Rhodesia, South West Africa, Transvaal; usually in dry grasslands, also in vleis.

SOUTH WEST AFRICA.—Okavango Native Territory: Andara, *Merxmüller* 2080 (M, PRE). Kaokoveld: Ondongwa, *Barnard* (SAM 44167, NBG); Namakunde, *Volk* 997 (M), *Barnard* 583 (NBG). Grootfontein: Omaue, *Volk* 2849 (PRE). Rehoboth: Goellschau, *Volk* (M 11496). Windhoek: Binsenheim, *Volk* (M 11034); Voigtland, *Volk* (M 11399).

SOUTHERN RHODESIA.—Inyanga: near Inyanga town, *Norlindh & Weimarck* 4140 (PRE, SRGH). Salisbury: Marandellas, *Wild* 3292 (SRGH). Umvukwes: Darwin, Umsengedzi River, *Wild* 3984 (SRGH). Umtali: Dora Ranch, *Chase* 6362 (SRGH). TRANSVAAL.—Pretoria: Bronkhorstspuit, *Repton* 1214 (PRE). Witbank: *Gilfillan* 7263 (PRE). Waterberg: near Vaalwater, *Meeuse & Srey* 10410 (PRE, BM).\*

The species is apparently very adaptable and this could be the reason for its wide distribution. Usually it is found in dry grassveld but Prof. Merxmüller collected his specimens in a vlei, the flowers floating on the surface of the water.

Baker describes the perianth with a circumscissile area at the base; it breaks off irregularly however, wherever pressure is greatest. The perianth may persist on top of the capsule, which is unusual for this genus.

A species closely related to *A. calyptrocarpum* Bak., is the Angolan species, *A. tenellum* Welw. ex Baker in J. Linn. Soc. Ser. 2, Bot. 1: 256 (1878); type: Angola, Morro de Monino, *Welwitsch* 3796 (BM, holo.). Mr. John Lewis of the British Museum who compared the types, found *A. tenellum* to be a more slender species.

\* TANGANYIKA.—Seronera to Kleins Camp, mile 57, *Greenway & Turner* 9997 (PRE).



13. *A. acutum* Wright in Kew Bull. 1914, 170 (1914). Type: Natal, Richmond, Ensiken, Haygarth in Hb. Wood 12063 (K, holo., NH, PRE, iso!).

Glabrous plants up to 80 cm high. *Roots* many firm, ca. 4 mm in diam. *Rhizome* small, usually covered with fibres of old leaf bases. *Leaves* subdistichous, ca. 8, becoming progressively longer, linear-lanceolate, up to 50 cm long, 1–2 cm broad, tapering gradually to the apex, clasping at the base, thin, flat, ribbed. *Inflorescence* a sub-simple, lax raceme or with 1–2 short, basal branches; scape terete, bracteate with 1–3 sterile, leaf-like bracts, fertile bracts resembling the sterile bracts but becoming smaller; pedicels very short in bud, up to 8 mm in fruit, articulated near the middle; flowers 1–2-nate, the secondary flower (or flowers) sometimes borne on contracted, bracteate side branches. *Flowers* with perianth segments up to 17 mm long, with a broad 5-ribbed green keel; filaments glabrous, slightly dilated at the base, about 8 mm long; ovary narrow, oblong, 4 mm high, ca. 20 ovules per cell. *Capsule* (immature) cylindrical, 3 grooved, 15 mm long, 5 mm in diam., green, coriaceous, with transverse wrinkles, the persistent style-base forming an apiculus. *Seeds* (immature) black, angular with a well developed funicle.

Flowering Period: December, probably short.

DISTRIBUTION: Southern Natal, north eastern Cape.

NATAL.—Richmond: Hutchinson 1829 (PRE, GRA); Underberg: Drakensberg Garden, Werdermann 1421 (B). Giant's Castle: Symons (TM 25296, PRE).

CAPE.—Mount Currie: Kokstad, Hutchinson 1829 (PRE).

This species is of interest as it shows a link between the truly distichous species with several flowers in the axil of an outer bract and those that are rosulate and have only one flower in the axil of each outer bract. The arrangement of the bi-nate flowers shows that it is the vestige of a contracted raceme, for the second flower is sometimes situated on a peduncle bearing small bracts. Fruiting material was collected for the first time by Werdermann 1421 (B) at Underberg. Although the capsules were not yet quite ripe, they showed a resemblance to those of *A. haygarthii*. The seeds although shrunken and immature, showed many folds and would probably become angular when ripe.

14. *A. longistylum* Bak. in J. Linn. Soc. 15: 305 (1876); Fl. Cap. 6: 381 (1896). Type: Transvaal, Baines (K, holo.).

*A. polyphyllum* Bak. in Fl. Cap. 6: 383 (1896). Type: Transvaal, Barberton, Galpin 1149 (K, holo., PRE, GRA, iso!). *A. recurvifolium* Bak. in Kew Bull. 1906: 28. Type: Southern Rhodesia, near Salisbury, Cecil 143 (K, holo.). Fig. 2.

Glabrous plants up to 100 cm high. *Roots* numerous, fibrous, firm, up to 3 mm in diam. *Rhizome* woody, usually covered with fibres from old leaf-bases. *Leaves* many, rosulate, erect, or sometimes curled back, linear, up to 30 cm long, 2–8 mm broad, long tapered in upper half, clasping below, folded, ribbed, margin minutely papillate. *Inflorescence* a lax ascending panicle, sometimes simple, many flowered with the solitary flowers subtended by a bract and bracteole; scape terete, bracteate; basal sterile bracts leaf-like; fertile bract small, ovate-acuminate, auriculate, bracteole smaller, situated obliquely opposite bract, 2-cleft to emarginate with the apices usually unequal; pedicels short, up to 4 mm, stout and erect in fruit, articulated below the middle. *Flowers* with the perianth segments lanceolate, 13–16 mm long, reflexed when open; stamens declinate, 4 erect, 2 decumbent with style, filaments short, glabrous, flattened; anthers large, 7 mm; ovary ovate, acute with 9–30 ovules per loculus, style exceeding the perianth. *Capsule* erect, ovate, beaked, 13 mm long, 6 mm in diam., glabrous, transversely rugose, apiculate. *Seeds* typical.

Flowering Period: November–March.

DISTRIBUTION: Natal, Transvaal, Bechuanaland, Southern Rhodesia; dry bushveld, rocky slopes or sandy flats.





FIG. 2.—*Anthericum longistylum* Bak. a, habit showing rosulate leaves  $\times \frac{1}{3}$ . b, capsule,  $\times 2$ . c, outer auriculate bract and inner emarginate bracteole,  $\times 2$ . d, flower.

NATAL.—Bergville: *Killick* 1043 (PRE).

TRANSVAAL.—Barberton: *Galpin* 408 (PRE). Nelspruit: Kruger National Park, Pretorius Kop, *Codd* 5664 (PRE, SRGH). Pilgrim's Rest: *Rogers* 18238 (PRE); *Killick & Strey* 2558 (PRE). Pretoria: Premier Mine, *Rogers* 25033; Hammanskraal, *Kies* 367 (PRE), *Codd* 3493 (PRE). Letaba: Tzaneen, *Phillips* 3294 (PRE). Waterberg: near Maraheki, farm Waterval 6, *Meeuse & Strey* 10381, 10383 (PRE).

CAPE.—Mafeking: *Brueckner* 453 (PRE).

BECHUANALAND.—Near Derdepoort, *Codd* 8893 (PRE), 8862 (PRE, SRGH). Gaborones, *Van Son* (TM 28665, PRE). Mahalapye, *de Beer* 555 (SRGH).

SOUTHERN RHODESIA.—Rusape, *Dehn* R 59 (SRGH). Bulalima—Mangwe: Embakwe, *Feiertag* 45411 (SRGH). Salisbury: Beatrice, *Drewe* 47 (SRGH). Matobo, *West* 2447 (SRGH).

The types of *A. longistylum* and *A. polyphyllum* were compared at Kew by Mr. W. Marais who found them to be conspecific. The filaments of *A. polyphyllum* are glabrous and not scabrous as described. Baker describes the flowers of *A. longistylum* as 2–3-nate, but this is somewhat misleading for the flowers, although sometimes found close together, do not emerge from the axil of one bract. The part of the scape present on the type of *A. longistylum* is bare but this is unusual. The leaves of some specimens are very narrow.

15. *A. radula* Bak. in Bull. Herb. Boiss. Ser. 2, 1: 781 (1901). Type: Transvaal, Pietersburg, Houtbosch, *Rehmann* 5805 (Z, holo., PRE, photo.).

Plants resembling *A. longistylum*, but with the inflorescence glandular-scabrid. *Roots* many, long, firm. *Rhizome* short, covered with fibres from old leaf bases. *Leaves* rosulate, many, linear, ca. 20 cm long, 4 mm wide, folded, glabrous, rigid, ribbed. *Inflorescence* branched, glandular-scabrid, 35 cm high; scape firm, terete, bracteate, glabrous at the base, scabrid with stipitate glands above; lower sterile bracts large, leaf-like; each solitary flower subtended by a bract and bracteole; bract ovate, membranous, bracteole smaller, unequally bifid; pedicels 3 mm long. *Flowers* with perianth segments 16 mm long, 2 mm broad; filaments smooth, 4 mm long; anthers 4 mm; ovary ovoid, apex acute, style exserted, declinate. *Capsule* unknown.

Flowering Period: Not stated, probably December.

DISTRIBUTION: Transvaal, Houtbosch, only known from the type locality.

TRANSVAAL.—Pietersburg: Houtbosch, *Rehmann* 5805 (Z, holo., PRE, photo.).

The species very closely resembles *A. longistylum* and may eventually prove to be a glandular variety of this species.

16. *A. transvaalense* Bak. in Fl. Cap. 6: 384 (1896). Type: Transvaal, Barberton, *Galpin* 1035 (K, holo., PRE, NH, GRA, iso.).

*A. indutum* Poelln. in Fedde, Rep. 50: 232 (1941), nom. nov. for *A. vestitum* Bak. ex Schinz in Viert. Nat. Ges. Zürich, 49: 174 (1904); non Bak. in J. Linn. Soc. 15: 307 (1876). Type: Transvaal, Pietersburg, Shiluvane, *Junod* 862, 1441 (K, holo.).

Plants up to 80 cm high. *Roots* numerous, firm, ca. 2 mm in diam. *Rhizome* woody, horizontal, covered with fibres of old leaf bases. *Leaves* rosulate or semistichous, straight or in a loose spiral, erect, 5–35 cm long, up to 6 mm broad, closely ribbed (midrib absent) flat, setose with long, white, patent hairs. *Inflorescence* glutinous, simple, seldom with a short basal branch, many flowered, elongating during anthesis; scape terete, pubescent, bracteate above, sterile bracts pubescent, leaf-like but smaller and narrower; each solitary flower supported by a large glabrous ovate, acute, auriculate bract and a bracteole with 2 long subulate horns; pedicels up to 3 mm in fruit, articulated in the middle. *Flowers* closely arranged on rhachis with bracts imbricate; perianth glutinous, segments 13 mm long, filaments short, anthers 5 mm long; ovary ovoid, each cell with ca. 15 ovules. *Capsule* ovoid, beaked, transversely rugose. *Seeds* typical.

Flowering Period: November–April.

DISTRIBUTION: Orange Free State, Swaziland, Transvaal, Southern Rhodesia, usually in grassveld on rocky outcrops.

ORANGE FREE STATE.—Senekal: Ferrara, iron stone hills, *Goossens* 984 (PRE).

SWAZILAND.—Stegi, Isateki Beacon, *Compton* 27297 (PRE).

TRANSSVAAL.—Belfast: *Bolus* 12385 (PRE). Benoni: *Bradfield* 327B (PRE). Krugersdorp: Muldersdrift, *Gilliland* (J. 26103, PRE). Middelburg: *Mogg* 17314 (PRE). Lydenburg: Steenkampsberg, *Codd* 8222 (PRE, SRGH). Pietersburg: Woodbush Hill, *Pott* 4730 (PRE); Haffenden Heights, *Junod* 4120 (PRE).

SOUTHERN RHODESIA.—Inyanga, *Hopkins* (SRGH 9448); *Whellan* 603 (SRGH).

Like *A. longistylum* Bak. and *A. haygarthii*, this species also has narrow-leaved forms.

17. *A. haygarthii* (Wood & Evans) Kies comb. nov.

*Chlorophytum haygarthii* Wood & Evans in J. Bot. Lond. 37: 254 (1899). Type: Zululand, 'Nkandla, *Haygarth* in Hb. Wood 7448 (NH, holo., PRE, iso.).

*Anthericum bracteatum* Thode ex Poelln. in Fedde, Rep. 53, 6: 126 (1944). e descr. Type: Natal? Transvaal? "On stony kopje and plateau, 2100 M" *Thode* 3500, flow. January 1921 (B, holo., probably destroyed).

Plants up to 80 cm high. *Roots* many, firm, stout, 3 mm in diam. *Rhizome* small, woody, obliquely horizontal, covered with fibres of old, persistent leaf-bases. *Leaves* semi-distichous, linear to lanceolate, 20–80 cm long, up to 14 mm broad, tapered in upper half, base clasping, ribbed, glabrous, firm, flat. *Inflorescence* a simple raceme, many and closely flowered, with bracts imbricate; scape terete, stout, glabrous, with several leaf-like sterile bracts; rhachis pubescent and viscous above; each solitary flower with a membranous ovate bract and an inner oblique boatshaped bracteole, which covers the bud; pedicels erect, stout, 5 mm long in fruit, articulated in the middle. *Flowers* with perianth segments 15 mm long; stamens with glabrous filaments; ovary ovoid, with ca. 12 ovules per cell. *Capsule* ovoid, transversely rugose, sutures prominent, apex beaked. *Seeds* typical.

Flowering Period: November–February.

DISTRIBUTION: Natal, eastern Transvaal, stony slopes and swamps.

ZULULAND.—Ubonbo: *Gerstner* (NH 22874).

NATAL.—Vryheid: *Galpin* 10198 (PRE). Paulpietersburg: Dumbé Mountain, *Galpin* 9654 (PRE).

TRANSSVAAL.—Ermelo: Mavriestad, *Pott* 5173 (PRE). Wakkerstroom: *van Dam* (TM 24339, PRE); *Thode* (NH 16488). Barberton: Schagen, slopes of Amajuba Mountain, *Liebenberg* 3105 (PRE). Pilgrim's Rest: Mauchsberg, *Sabie*, *Smuts* & *Gillet* 2384 (PRE); Graskop, *Codd* 6736 (PRE). Belfast: Dullstroom, *Galpin* 13045 (PRE).

*A. transvaalense* and *A. haygarthii* are closely related.

SPECIES EXCLUDED \*

*A. brevicaule* Bak. in Journ. Linn. Soc. XV: 298 (1876); Fl. Cap. 6: 391 (1897). Type: South Africa without locality, *Thunberg* (UPS?). *Caesia brevicaulis* (Bak.) Dur. & Schinz, Consp. Fl. Afr. V: 353 (1895). Identified as *Caesia contorta* (L.f.) Dur. & Schinz.

*A. brevifolium* Thunb. Prodr. 62 (1794). Bak. in Fl. Cap. 6: 388 (1897). Type: South Africa, without locality, *Thunberg* (UPS, holo., PRE, photo.). Identified as *Caesia contorta* (L.f.) Dur. & Schinz.

\* See also p. 759.

*A. longipedicellatum* Poelln. in Fedde, Rep. 53: 128 (1944). Type: Cape, Riversdale, Rust 14 (B, holo.!, PRE photo.). Identified as *Ornithogalum zeyheri* Bak.

*A. macranthum* Bak. in Viert. Nat. Ges. Zürich 49: 175 (1904). Type: Transvaal, Letaba, Spelonke, top of Mamotsuiri, Junod 1448 (G, holo.!, PRE, photo.). Identified as an *Albuca* sp.

*A. multiceps* Poelln. in Bol. Soc. Brot. 16, 2: 68 (1942). Type: Cape, Riversdale, Rust 237 (B, holo.!, PRE, photo.). Identified as *Bulbine frutescens* Willd. var.

*A. nonscriptum* Poelln. in Bol. Soc. Brot. 16, 2: 45 (1943). Type: Ex hortus Berlin-Dahlem, 1826-7 (B, holo., probably destroyed in 1943). Poellnitz thought it originated from the Cape. Identified by Kies as *A. ramosum* L. from Europe.

*A. pauper* Poelln. in Bol. Soc. Brot. 16, 2: 47 (1942). Type: Transvaal: Heidelberg, Wilms 1542 (B, holo.!, PRE, photo.). Identified as *Ornithogalum leptophyllum* Bak.

*A. quadrifidum* Poelln. In Bol. Soc. Brot. 16, 2: 47 (1942). Type: Cape: Pondoland, Port Grosvenor, Bachmann 276 (B, holo.!, PRE, photo.). Identified as *Ornithogalum leptophyllum* Bak.

*A. seineri* (Engl. & Krause) Poelln. in Fedde, Rep. 53: 136 (1944). Identified as *Ornithogalum seineri* (Engl. & Krause) Oberm. cf. *Bothalia* 7: 401 (1961).

*A. unilaterale* Thunb. nom. tant. ex Juel, Plant. Thunb., 121 (1918), (UPS, PRE, photo.). Possibly *Eriospermum cernuum* Bak.

For species excluded from *Anthericum* before 1897 the Flora Capensis vol. 6 should be consulted.

## 2. CHLOROPHYTUM

Ker Gawler in Bot. Mag. t.1071 (1808); Kunth, Enum. 4: 602 (1843); Baker in J. Linn. Soc. 15: 321 (1876); Benth & Hook. Gen. Pl. 3, 2: 788 (1883); Krause in Engl. & Prantl, Pflanzenfam. 15, A: 284 (1930); Phillips, Gen. S.A. Flow. Pl. ed. 2: 183 (1951).

*Asphodelopsis* Steud. ex Bak. in J. Linn. Soc. 15: 321 (1876).

*Hartwegia* Nees in Nov. Act. Nat. Cur. 15, 11: 372 (1831).

Herbaceous perennials the parts above ground persistent or dying down in winter. *Roots* variable, usually long, many, swollen, rarely wiry and with scattered tubers, in some south western Cape species, with sessile "tubers" (arrested roots) on the rhizome. *Rhizome* creeping, sometimes covered with fibres (the remains of old persistent leafbases). *Leaves* rosulate, rarely subdistichous, a few or many, rarely 1; lamina usually flat, glabrous or pubescent, rarely glandular, base often tapered into a "petiole", margin usually fimbriate. *Inflorescence* a central, simple or branched raceme, rarely glandular-pubescent; scape terete, bracteate; bracts large or small; pedicels articulated near or below the middle, rarely at the apex. *Flowers* 1-6-nate, opening consecutively, open all day. *Perianth* rotate or reflexed, rarely cup-shaped or urceolate, white, rarely pinkish, translucent, keel becoming dark with age; the 3 outer segments slightly narrower than 3 inner; marcescent, covering capsule, rarely reflexed in fruit. *Stamens* 6, hypogynous; filaments glabrous or papillate, shorter, or in certain species, longer than the segments; anthers basifixed, usually large, introrse. *Ovary* sessile or shortly stipitate, trigonous with 6-30 biseriate ovules; style simple, smooth; stigma minute, penicillate. *Capsule* trigonous, oblong, obcordate, or globose in outline, smooth or with transverse ridges or tuberculate. *Seeds* large, flat, round in outline with a notch where the pointed hilum is situated, testa black shiny, minutely granulate.

DISTRIBUTION: Africa, Madagascar, Asia.

Type Species: *Chlorophytum inornatum* Ker Gawler.



Like *Anthericum*, *Chlorophytum* is a widespread genus containing nearly 300 species most of which are found in tropical Africa, with some in Madagascar and a few in Asia. In South Africa the twenty species could be divided into two sections which coincide with their geographical distribution, namely nine from the winter rainfall area and therefore confined to the south-western Cape, and eleven from the summer rainfall region, these latter being more closely related to the tropical species. *Chlorophytum inornatum* is the type species of the genus published by Ker Gawler in 1804. It comes from Sierra Leone, but is not found in Namaqualand as Baker led us to believe in the Flora Capensis. On the whole our South African species are fairly uniform and fit in well with the genus. There remains, however, the problem whether to accept *Dasystachys* as a separate genus or as a section of *Chlorophytum*. For the present I regard only those species which have single flowers, each supported by a bract and bracteole, a simple raceme, non-articulated, very short pedicels and exserted stamens as true *Dasystachys*. But *Chlorophytum papillosum* Rendle which reaches our northern borders seems to form a link between these two genera. It possesses the exserted stamens and the non-articulated pedicels but its flowers are arranged in clusters. *Dasystachys* has the typical *Chlorophytum* type of capsule and seed and was considered to be a section of it by Engler and von Poellnitz. Baker referred it to *Dasystachys* but I have left it under *Chlorophytum*.

**GEOGRAPHICAL NOTES.**—On the whole the species are found to inhabit fairly small areas. *C. comosum* has a wide distribution but it has the same range as the eastern forests which it inhabits. With *C. modestum* and the subtropical species *C. gazense* and *C. laxum*, etc., it forms a group of closely related, shade and moisture loving species. *C. papillosum* also has a wide distribution in the Zambesi lowlands. *C. capense*, *C. bowkeri*, *C. krookianum* and *C. aridum* are closely related and are found in more open country where they occur in clumps in the shade of small thickets. Their leaves are firmer and usually slightly fleshy; the more favourable the situation the broader the leaf. The south-western Cape species are xerophytic. Why they do not dry black and why the others from the summer rainfall area do, could not be explained. Dr. P. H. B. Talbot examined the root of a specimen of *C. bowkeri* but he found no signs of mycorrhiza.

## MORPHOLOGY

**Roots:** They are typical for each species or group of closely related species. The roots are numerous, long, thin or evenly or unevenly swollen. Those of *C. triflorum* are unique; they are hard and dark-coloured, swollen near the insertion to the rhizome and tapering gradually to the tip. *C. viscosum* has pink roots which are narrowly cylindrical; they become hollow when dry through shrinkage of the spongy mesoderm. *C. rigidum* has thin, wiry roots which show affinity to certain species of *Anthericum*. *C. trachycarpum* from northern South West Africa and Southern Rhodesia also has thin roots but these bear tubers near the tips also reminiscent of *Anthericum*. *C. undulatum* and *C. crassinerve* often possess sessile "tubers" on the rhizome. These "tubers" are roots arrested in their development, an adaptation to dry, unstable conditions. If the conditions become favourable, they will elongate. If they were favourable from the start no "tubers" are formed, the roots then merely showing a spindleshaped thickening near the tip. In most species, especially those from the summer rainfall area, the mesoderm is spongy and there is a thin, inner, woody core. The root hairs are extremely well developed attaining up to 2 mm in length; they intertwine and form a matted surface. With age the root hairs and mesoderm disappear leaving only the thin, hard core.

**Rhizome:** The perennial rhizome is small and compact forming new plants horizontally.

**Leaves:** These show much variation especially in the south-western Cape species, where they have adapted themselves to dry conditions. Here we get such xerophytic adaptations as a reduction in the number of leaves, narrow lamina, pubescence, folding or twisting and a hardening of the epidermis. The margin of the leaf is ciliate in nearly all species. In some of the south-western Cape species the primary leaves remain small and resemble ligulate squamae, often purple spotted. The hard sclerenchymatous nerves of the leaf-bases persist as fibres in these species.

**Inflorescence:** It is a simple or branched raceme. Its flowering time is extended over a long period, as the many buds in each axil develop consecutively. Each axillary fascicle of flowers may be regarded as a reduced flowering branch. Occasionally in *C. crispum* and *C. capense*, we still find a minute peduncle on which these axillary flowers are arranged spirally. If flowering conditions are favourable, many flowers are produced; if it is too cold or too dry, many buds remain latent or are retarded so that in one axil a capsule, a flower and small buds may be found side by side. In this way the inflorescence will flower for months and incidentally it is the only one produced (centrally) during the season. This is in sharp contrast to *Trachyandra* and *Bulbine* where the (axillary) inflorescence appears, flowers and fades within a short period, perhaps a fortnight, whilst subsequent young racemes are to be seen near the base, developing and flowering soon after a rainy spell. As the bracts may be regarded as the equivalent of the leaves, the oldest and sterile ones found on the scape are the largest and still very leaf-like; the floral ones are small. If the leaf shows a special characteristic, such as long cilia on the margin, the floral bracts will also show this. The pedicels are usually articulated near the middle, rarely near the base (*C. rigidum* and *C. monophyllum*) or near the apex (*C. macrosporum* and *C. trachycarpum*). If not fertilized the flower drops off at the articulation. In those with the articulation near the base, the upper part of the pedicel has elongated during anthesis; in those with articulation near the apex, the lower part has developed. The location of the articulations is constant for each species as in *Anthericum*. The pedicels do not change their position while the capsule ripens. This they have in common with *Anthericum* but it is in contrast to the genus *Trachyandra* and some species of *Bulbine* where the position of the pedicel changes after the flower has dropped off if not fertilized, or when a capsule is formed.

**Flowers:** They are white, consisting of delicate, many cornered, transparent, watery cells which reflect the light in all directions, giving it a crystalline, translucent appearance. The keel is not visible at first, but appears when the tepals fade. The perianth is usually rotate, sometimes reflexed straight back; in *C. papillosum* it is cupshaped; in *C. macrosporum* the perianth is urceolate at the base with the segments ligulate above the cup, not at all like the usual flower form. The flowers are open all day and are apparently scentless. The perianth is persistent, either fitting closely around the capsule or reflexed. The segments do not fuse at the top in fading as in *Trachyandra*. The *stamens* have very delicate filaments which shrivel up unevenly so that they sometimes have a rough surface when dry. In some species they are scabrid but in the majority the surface appears smooth or, when magnified, with retrorse, short papillae. They are usually shorter than the perianth except in *C. papillosum* where during anthesis, they elongate beyond the perianth cup. Apparently the rate of growth varies in the filaments, some developing more slowly. The large, introrse anthers are basifixed and curl backwards when fading. The *ovary* is usually oblong to obovate or globose in outline. The *ovules* are biseriate and vary from 6-11 in certain species whereas in others we find 20-30 per loculus. It may happen that a whole row doubles itself so that for instance, 30 instead of the usual 20 ovules may be found in a loculus. The *style* is simple and also elongates rapidly during anthesis. The *stigma* is minute, penicillate.

**Capsule:** It is trigonous, the seeds are flattened perpendicularly in each compressed compartment. The walls are usually smooth with a raised margin. In *C. rigidum*, *C. monophyllum* and *C. viscosum* transverse ridges are present, like those found on most *Anthericum* capsules. In *C. trachycarpum* the ovary is papillate, the papillae afterwards developing into irregular tuberculate ridges on the capsule.

**Seed:** It is flat, large (2–4 mm in diam.) round in outline and notched where the hard pointed hilum is situated; the testa is black, shiny, granular.

**Vegetative reproduction** occurs in all species through the formation of lateral buds on the rhizome. *C. comosum* is of special interest for its propagation by leaf tufts found at the apex of the inflorescence. These sink down to earth and become rooted.

**Chromosome Number:** The basic number of chromosomes was found to be seven in *C. krookianum* and *C. comosum* and in the tropical species *C. laxum* and *C. inornatum*.

## KEY TO SPECIES

- Species from summer rainfall area; filaments smooth (except *C. crispum*); plants usually drying black:
- Filaments shorter than perianth segments which are spreading or reflexed:
    - Inflorescence patently branched, floral bracts shorter than the flowers:
      - Ovary sessile:
        - Scape compressed, oval in cross-section, glaucous, coriaceous plants; S.E. Cape 1. *capense*
        - Scape terete:
          - Small plants 20–50 cm high, leaves flat up to 10 cm long, margin distinctly crisped fimbriate; filaments papillate; S.E. Cape..... 2. *crispum*
          - Larger plants, leaves more than 10 cm long, usually half-folded, margin smooth or minutely crisped fimbriate, filaments smooth; eastern Cape, Transvaal, Natal:
            - Leaves ca. 2 cm wide, usually half-folded, undulate; ovary with ca. 10 ovules in each cell, capsule globose; Transvaal bushveld..... 3. *aridum*
            - Leaves ca. 6 cm wide, flat or somewhat folded; ovary with ca. 16 ovules per cell, capsule oblong; large Aloe-like plants; eastern Cape to eastern Transvaal..... 4. *krookianum*
      - Ovary stipitate, perianth urceolate, pedicels very slender, up to 2.5 cm long; north-eastern Transvaal, Southern Rhodesia..... 5. *macrosporum*
    - Inflorescence simple or with 1–2 long, basal, ascending branches:
      - Capsule smooth, roots swollen:
        - Capsule obcordate in outline; raceme simple, scape arcuate at the base thrusting the few flowered raceme outside leaf-rosette; small plants found in the warm eastern coastal area..... 6. *modestum*
        - Capsule globose:
          - Leaves linear..... 7. *pulchellum*
          - Leaves lanceolate, attenuated towards the base; raceme often with a leafy apical tuft..... 8. *comosum*
        - Capsule oblong; raceme dense with flowers close together and the bracts usually larger than the flowers..... 9. *bowkeri*
      - Capsule tuberculate; roots thin with small tubers near the tips; northern South West Africa, Southern and Northern Rhodesia..... 10. *trachycarpum*
    - Filaments ultimately exerted from campanulate perianth; perianth glandular-papillate on outside. Northern South West Africa and southern tropical Africa.... 11. *papillosum*
- Species from winter rainfall area; filaments rough; plants not drying black; rhizome often with fibres:
- Inflorescence divaricately branched, seldom simple; roots all alike, thin or slightly thickened; leaves somewhat distichous, margin not fimbriate; fertile bracts small, clustered; pedicels articulated near the base; capsule transversely rugose:
    - Plants glabrous, roots thin:
      - Leaves numerous..... 12. *rigidum*
      - Leaf solitary..... 13. *monophyllum*
    - Plants glandular, roots pink, slightly swollen..... 14. *viscosum*



Inflorescence simple, rarely with 1-2 basal, ascending branches; roots various; leaves in a rosette; margin minutely fimbriate; fertile bracts usually large, often resembling the perianth; pedicels articulated near the middle; capsule smooth with a raised margin:

Roots all alike, hard, thickest at place of insertion to rhizome, tapering gradually, with some transverse wrinkles; Cape Peninsula and surrounding districts..... 15. *triflorum*  
 Roots various but not as above:

Leaves glabrous (except minutely ciliate margin):

Plants with many leaves:

Leaf margin not prominent, apex usually long tapering:

Leaves in an elongated rosette; roots hard, not much thickened; ovules ca. 18 per cell; Namaqualand..... 16. *namaquense*

Leaves usually in a flat rosette; roots all alike or dimorphous i.e. with anchoring roots which at first have a lanate, spongy skin which later sloughs off leaving a thin, hard, woody core, and often with small sessile tubers on rootstock between the old fibres..... 17. *undulatum*

Leaf margin raised, apex usually obtuse..... 18. *crassinerve*

Plants with one old and one young, green leaf; 1-2 short, membranous bract-like primary leaves present at the base..... 19. *pauciphyllum*

Leaves pubescent, rhizome small, bulbous..... 20. *lewisae*

1. *C. capense* (L.) Voss in Vilmorin's Blumeng. 1: 1086 (1895); O. Kuntze, Rev. Gen. Pl. 3: 316 (1898); Van Oostroom in Blumea 4: 495 (1941); Adamson & Salter in Flora of the Cape Peninsula, 185 (1950), as "*C. capense* (L.) Druce".

*Asphodelus capensis* L. Syst. Nat. ed. 10, 982 (1758). Type: Miller's Ic. t.56 (1760). Linnaeus describes the plant, "A scapo nudo, ramoso, fol. lanceolatis planis" and refers to this plate. The specimen No. 431-6, preserved in the Linnaean herbarium, with a simple raceme and named *Asphodelus capensis* L. Syst. Nat. ed. 10A does not represent this species. It was impossible to identify it however, from the indistinct photo at PRE.

*Anthericum rouwenortii* de Gorter, Cat. Plant. Hort. Ulenp. 51 (1783); van Oostroom in Blumea 4: 493 (1941). Type: probably Cape (L, holo.! PRE, photo.). It was said to have come from Ceylon but this was already doubted at the time. It was in cultivation at the Hortus Ulenpas in Holland round about the same time that *Anthericum elatum* Aiton was cultivated at Kew. They could have been raised from the same batch of seed which must have been collected in the south-eastern Cape. *A. elatum* Ait. in Hort. Kew, 1: 448 (1789). Type: Cape, probably (BM, holo., PRE photo.). Aiton refers to Miller's plate 56.

*Phalangium elatum* (Ait.) Redouté, Lil. t.191 (1807).? *P. fastigiatum* Poir. in Lam., Encycl. 5: 246 (1804). No type preserved. Redouté asserted that Poiré's species was not the same as Aiton's *A. elatum* but as no specimen exists, this cannot be verified. *P. "fasciculatum"* Bak. in J. Linn. Soc. 15: 331 (1876) in error for *P. fastigiatum* Poir.

*Chlorophytum elatum* (Ait.) R.Br. ex Sprengel, Syst. II: 88 (1825); Roem. & Schult., Syst. 7: 454 (1829); Kunth, Enum. 4: 604 (1843); Saunders in Ref. Bot. 3, t.216 (1870); Bak. in J. Linn. Soc. 15: 330 (1876), et in Fl. Cap. 6: 399 (1897).

Herbaceous, glaucous plants up to 1 m tall. *Roots* many, long fleshy. *Rhizome* small, vertical. *Leaves* many, in an elongated rosette, linear-lanceolate 30-45 cm long, 25 mm broad, gradually narrowed towards the apex, base clasped firmly around rhizome and other leaves, closely ribbed, glaucous, coriaceous, glabrous. *Inflorescence* a tall, much branched raceme with several to many ascending, lateral branches; scape compressed, firm, with some leaf-like bracts, covered with a white bloom; fertile bracts small, deltoid; pedicels short, up to 4 mm, articulated above the middle when in fruit. *Flowers* laxly arranged, 3-many nate, if many, arranged in short, spiral, bracteate fascicles; perianth rotate with segments 9 mm long; filaments glabrous (minutely papillate when magnified); ovary with ca. 10 ovules per cell. *Capsule*



8 mm, broadly obovate in outline, apex deeply emarginate. *Seeds* typical, 3 mm in diam.

Flowering Period: October–May.

DISTRIBUTION: Known only from the eastern Cape, Humansdorp to Albany districts.

CAPE.—Humansdorp: Jeffrey's Bay, Lewis 3608 (NBG), Fourcade 4321 (BOL). Uitenhage: Sandhills, Ecklon & Zeyher 111 (NBG). Port Elizabeth: Cradock Place, on downs, Galpin 6448 (PRE, GRA); Redhouse, Paterson 1960 (GRA); Mackay Bridge, Sundays River, Urton 240 (GRA); Addo, Drège 8719a (L), 8719 (K). Albany: bank of Fish River, Penrock farm, Dyer 1188 (PRE). King William's Town: Pirie, Sim 1104 (PRE).

Miller's plate, t.56, was made from a plant raised from seed in the Chelsea Garden in 1751; it flowered in March the following year. Miller stated that part of the seed parcel went to Holland. He goes on to say that although he could not find a reference to it in any botanical books, it seems likely to have been cultivated formerly in the Dutch gardens for it can be seen on flower paintings, which were painted up to sixty years previously. Whether the flowers painted were really those of *Chlorophytum capense* we do not know. The shape of the flower is so elementary that several other species might also have been mistaken for it, e.g. *Trachyandra hirsuta*. After the 1751 consignment of seeds, he mentions that several more packets arrived and he therefore supposed it to be quite common at the Cape. But he describes the seeds as angular, which is not correct. The capsule on the plate is deeply grooved, therefore the seeds inside must have been compressed, which is typical for *Chlorophytum*. Once again he may have confused the seeds with those of a *Trachyandra* species.

The species is endemic in the eastern Cape where it has been collected in dry, shady vegetation on river banks, often near the sea. Redouté's plate (Lil. t.191) and that of the Ref. Bot. 3: t.216 are more life-like. It is doubtful whether it ever occurred on the Peninsula. Adamson says "doubtfully native, rare under trees or by streams on the Groote Schuur and Newlands Housing Estates". I think these Cape Peninsula plants are better placed under *C. comosum*.

2. *C. crispum* (Thunb.) Bak. in J. Linn. Soc. 15: 331 (1876); Fl. Cap. 6: 398 (1897).

*Anthericum crispum* Thunb. in Prod. 63 (1794); Thunb., Fl. Cap. ed. Schultes, 324 (1823). Type: Cape, Thunberg (UPS, holo., PRE, photo.). *Anthericum rustii* Poelln. in Fedde, Rep. 53: 127 (1944), e descr. Type: Cape, Riversdale, Rust 298 (B, holo., probably destroyed). Poellnitz says the type was leafless. It is almost certainly this species. *Anthericum rosenbrockii* Poelln. in Bol. Soc. Brot. 16: 69 (1942). Type: Cape, Port Elizabeth, Rosenbrock 82 (B, holo.! PRE, photo.). *Bulbine crispa* (Thunb.) Roem. & Schult., Syst. Veg. 7: 448 (1829); Kunth, Enum. 4: 568 (1843).

Small plants variable in size. *Roots* many, unevenly swollen, spongy below, older parts thinner and harder. *Rhizome* compact, vertical. *Leaves* forming a flat rosette, linear-lanceolate to ovate-lanceolate, 3–10 cm long, 5–15 mm broad, herbaceous, striate, glabrous but for the prominent, fimbriate, crisped margin, base cuneate, apex acuminate. *Inflorescence* a much branched raceme, up to 50 cm high, usually smaller, sometimes simple in starved plants; scape terete, glabrous, bracteate, fertile bracts resembling the sterile ones, small, 3 mm long, deltoid; pedicels up to 6 mm in fruit, articulated in the middle. *Flowers* 1–15 nate, if many, spirally arranged on a minute rhachis; perianth rotate, segments 8 mm long, white, green keeled; filaments muricate; anthers basiflexe, revolute; ovary with ca. 8 ovules per cell; style declinate. *Capsule* 5 mm long, emarginate, with faint, transverse ridges. *Seeds* typical.

Flowering Period: September–May.

DISTRIBUTION: South-eastern Cape, Riversdale to Alexandria districts.

CAPE.—Riversdale: Hills near Riversdale, *Muir* 2757 (BOL). George: Keurboom's River, Longkloof, *Fourcade* 3393 (BOL). Oudtshoorn: Moeras Rivier, *Compton* 23158 (NBG). Uniondale: *Compton* 10540 (NBG); Misgund, *Esterhuysen* 6959 (BOL). Uitenhage: on sandhills near Zwartkops River, *Zeyher* 1069 (BOL, NBG, PRE). Alexandria: Addo National Park, Korhaan Vlake, *Archibald* 5266 (PRE).

3. *C. aridum* Oberm. sp. nov. *C. krookiano* Zahlbr. affine sed minore differt.

*Planta* glabra ad 1 m alta. *Radices* tumescentes. *Folia* lanceolata ad 30 cm longa 2 cm lata glabra striata marginibus crispulatis fimbriatis. *Racemus* erectus ramosus; bracteae inferiores 3 cm longae caducae superiores fertiles minutae deltoides; pedicelli in fructu filiformes 7 mm longi ad centrum articulati. *Perianthii segmenta* 9 mm longa; ovula in quoque loculo circ. 10. *Capsula* parva 5 mm longa globosa vel obcordata.

Plants glabrous, up to 1 m high. *Roots* typical, swollen, with many thin rootlets and the swollen parts covered with long, interwoven root hairs. *Rhizome* horizontal or vertical, small, woody. *Leaves* many, in a basal rosette, erect, linear-lanceolate, up to 30 cm long, 2 cm broad, semi-folded, glabrous, striate, margin white with a narrow red rim, crisped, fimbriate. *Inflorescence* an erect, branched, spreading raceme ca. 60 cm high; scape terete, bracteate, lower bracts up to 3 cm, caducous, upper fertile, minute, deltoid; pedicels filiform up to 7 mm in fruit, articulated in the middle. *Flowers* ca. 4-nate; perianth white, delicate, shiny, reflexed when fully open, free from the base, segments lanceolate, 9 mm long, 3 outer with a brown spot at the apex, the inner wider than outer, 5 mm broad; filaments glabrous, 3 mm, erect, spreading; ovary with ca. 10 ovules; stigma apical, minutely papillate. *Capsule* globose to obcordate in outline, 5 mm in length, emarginate, sulcate. *Seeds* 2 mm in diam.

Flowering Period: December–February. Bees collect much pollen from them.

DISTRIBUTION: Transvaal, drier areas of the Bushveld.

TRANSVAAL.—Lydenburg: Koffiehoogte in dry Bushveld, *J. M. J. de Wet* (Prinshof 001403) in flower Dec. 1956 (PRE). Pretoria: near Rust der Winter, *Mauve* 4067 (PRE, holo.), *Codd* 2225 (PRE); Rooikop, *Smuts & Gillett* 2526 (PRE). Potgietersrus: *Leendertz* TM 10172 (PRE). Waterberg: Towoomba Pasture Research Station, *Codd* 3620 (PRE); Soutpansberg: *Smuts & Gillett* 4115 (PRE). Kruger National Park, Mtile-kop, Klokwe, *van der Schyff & Marais* 3742 (PRE).

The plants increase in size in cultivation or in more moist and warm surroundings and the leaves then become wider and more flabby, reclining in the upper half. It then resembles *C. krookianum* although still smaller in all respects and with a more slender scape. After more research it might eventually be considered a variety of *C. krookianum*. It is also closely related to *C. capense* but the softer leaves with their crisped, fimbriate margin, the terete scape and the reflexed perianth distinguish it from the Cape species.

4. *C. krookianum* Zahlbr. in Ann. Nat. Hofmus. Wien, 15, 1: 19 (1900) e descr. Type: Cape, East Griqualand, Newmarket–Umzinkulu, *Krook* (Pl. Penth. 784, W, holo., destroyed); Cape: Port St. Johns, Isnuka, *Galpin* 3495 (PRE, neo.).

*C. longipedunculatum* Forbes in Bothalia 4: 37 (1941) et in Fl. Pl. S.A. 22: t.861 (1942). Type: Transvaal, Nelspruit, Sabie, *Pole Evans* 4247 (PRE, holo.).

*Anthericum magnificum* Poelln. in Bol. Soc. Brot. Ser. 2, 16: 44 (1942). Type: Natal, Umzinto, Campbellton–Dumisa, *Rudatis* 1845 (B, holo., PRE, photo.).

Large, glabrous plants up to 2 m tall when in flower. *Roots* typical. *Rhizome* small. *Leaves* many, in a basal rosette, erect or upper half reclining, lanceolate, up to 136 cm long, 7 cm wide, half folded, glabrous, shining, somewhat succulent, slightly narrowed to the clasping base, attenuate in upper half, margin narrow, membranous, yellow, sometimes crisped, fimbriate. *Inflorescence* a tall, branched raceme with 4–8 ascending branches, up to 2 m; scape woody, terete, bracteate; sterile bracts

up to 16 cm long, fertile usually small, deltoid, acuminate, scarious, caducous; pedicels short during anthesis, up to 22 mm long in fruit, articulated in the centre. *Flowers* in compact fascicles, 3–6 nate; perianth rotate with white, delicate, shiny segments ca. 16 mm long, 4 mm wide, 3 exterior ones with a green dot at the apex, becoming red-streaked when fading; filaments 5 mm, glabrous, declinate; ovary with 15–20 ovules per cell: style declinate, stigma apical, minutely penicillate. *Capsule* oblong, ca. 12 mm. long, attenuated to the base, coriaceous. *Seeds* typical.

Flowering Period: January–April.

DISTRIBUTION: Eastern Cape, Natal, Swaziland to eastern Transvaal, usually in moist situations.

CAPE.—Port St. Johns: Isnuka, *Galpin* 3495 (PRE, neo, BOL).

NATAL.—Alfred: near Stafford's Post on Harding Road, *Marais* (PRE, GRA). Pietermaritzburg: *Dyer* (PRE). Lion's River: Nottingham Road, *McClean* 892 (PRE). Weenen: Estcourt Research Station, laboratory kloof, *West* 1783 (PRE). Estcourt: Loskop, Cathkin Park, *Howlett* 115 (NH). Zululand, *Howlett* (NH 40426).

SWAZILAND.—Hlatikulu, *Stewart* (BOL 10072, PRE, TM 9640); *Compton* 26398 (PRE, Swaziland Herb.).

TRANSVAAL.—Barberton: *Liebenberg* 2462 (PRE); *van Dam* (PRE, TM 21147).

† This is the largest *Chlorophytum* in South Africa. Although the type was destroyed, the description and the locality indicated this species.

5. *C. macrosporum* Bak. in J. Linn. Soc. 15: 330 (1876) et in Fl. Cap. 6: 400 (1897). Type: "South African Goldfields" *Baines* s.n. (K, holo.). The type locality is most probably in Southern Rhodesia where the species occurs. *C. rhodesianum* Phill. in Fl. Pl. S.A. 14, pl. 540 (1943). Type: Southern Rhodesia, Bulawayo, *Pole Evans* (PRE 8821, holo.).

Plants glabrous, up to 150 cm high. *Roots* thick, numerous, lanate. *Rhizome* compact, woody. *Leaves* in an ascending, basal rosette, linear-lanceolate, up to 40 cm long, 15 mm broad, tapering towards base and apex, usually half-folded, glabrous, somewhat glaucous, margin wavy. *Inflorescence* a tall, branched, spreading raceme, many flowered, much taller than the leaves; scape terete, bracteate; bracts lanceolate-acuminate, upper fertile bracts deltoid, acute; pedicels 1 cm in bud, up to 2.5 cm in fruit, articulated above the middle. *Flowers* 2–6 nate; perianth urceolate at the base, the free part of the segments narrowed at the base, ligulate, 15 mm long, reflexed in the open flower and in fruit, greenish; filaments smooth, spreading, swollen in upper part, 3 much shorter than the others, anthers typical; ovary stipitate, protruding from the perianth cup, with ca. 20 ovules per cell. *Capsule* oblong, 10–15 mm long, stipe very short or absent. *Seeds* typical, 3 mm in diam.

Flowering Period: November–March.

DISTRIBUTION: Southern and Northern Rhodesia, northern Transvaal.

TRANSVAAL.—Sibasa: Kruger National Park, Punda Maria, *Lang* (TM 32253, PRE); Baiandbai, *Lang* (TM 32147, PRE, NH); between Mabase and Baiandbai, *Lang* (TM 31105, PRE).

SOUTHERN RHODESIA.—Bulawayo, *Kolbe* 4026 (BOL), *Rogers* 13801 (SRGH). Salisbury: *Eyles* 593 (SRGH); *Wild* 2292 (SRGH). Matobo, *Miller* 2042 (SRGH, PRE). Umtali, *Chase* 4288 (SRGH). Manica: Odzani River Valley, *Teague* 352 (BOL). Nuanetsi, *Davies* 1712 (SRGH, PRE). Hartley: *Hornby* 3387 (PRE, SRGH). NDanga: Lundi, Sabie River, *Hall* (NBG 540/50).

NORTHERN RHODESIA.—Lusaka, *Noak* 294 (SRGH).

The species is unusual because of the cup-shaped base of the perianth and the stipitate ovary, which is not noticeable in the fruit however. It shares this charac-



teristic with *C. andongense* Bak. from Angola, which must be very closely related to it or perhaps conspecific. The leaves of *C. andongense* Bak. are broader.

6. *C. modestum* Bak. in J. Linn. Soc. 15: 329 (1876) et in Fl. Cap. 6: 397 (1897). Type: Natal, Krauss 177 (K, holo.).

*C. durbanense* O. Kuntze, Rev. Gen. 3, 2: 316 (1898). Type: Natal, Durban Bluff, Kuntze (NYS, holo., PRE, photo.).

Small plants up to 30 cm high. *Roots* typical, many, long, swollen. *Rhizome* compact, vertical. *Leaves* linear-lanceolate, 15–23 cm long, thin, soft, flat, glabrous, apex acute, tapered towards the base into a long “petiole”, membranaceously dilated at the clasping base. *Inflorescence* simple, very seldom with a short, basal side branch, few flowered; scape arcuate at the base, so that the raceme is exerted outside the leafy rosette, as long as or somewhat longer than the leaves; lowest bract linear, acuminate, up to 2 cm long, upper smaller, subulate; pedicels short, 4 mm in fruit, articulated below the middle. *Flowers* 1–4 nate; perianth with segments 1 cm long; filaments glabrous; ovary with 4–6 ovules per cell. *Capsule* obovoid, 1 cm long, 8 mm wide at the emarginate apex. *Seeds* typical, 3 mm in diam.

Flowering Period: November–March.

DISTRIBUTION.—A forest and coastal bush species found in Pondoland, Natal and Portuguese East Africa, perhaps extending further northwards.

CAPE.—Port St. Johns: Moss 3489 (PRE); Schonland 3982 (PRE). Lusikisiki: Blenkiron 16042 (BOL).

NATAL.—Durban: Berea, Wood 9187 (PRE), 9406 (NH). Estcourt: Loskop, Cathkin Park, Howlett 8 (PRE). Umzinto: Scottburgh, common on the pavements and in clearings, usually in shady situations, Mauve 4049 (PRE).

PORTUGUESE EAST AFRICA.—Lourenço Marques, Polana, Gomes Pedro 48 (PRE).

Related to the tropical African species *C. gazense* Rendle, *C. laxum* R. Br. and *C. petiolatum* Bak.

7. *C. pulchellum* Kunth, Enum. 4: 605 (1843); Bak. in Fl. Cap. 6: 398 (1897). Type: South Africa, Lalande (B, holo., probably destroyed). As Lalande collected in the eastern Cape, it is probable that the species came from that area. Queenstown, Gwatyn Farm, mountain sides, Galpin 8333 (PRE, neo.).

Small plants up to 70 cm high. *Roots* many, swollen near the tips. *Rhizome* small, vertical, with some fibres from old leaf bases. *Leaves* forming a loose rosette, spreading from near the base, ca. 9 per shoot, linear, up to 30 cm long, 4 mm wide, folded ribbed, hard, glabrous. *Inflorescence* a long simple or few branched raceme, up to 70 cm high; scape longer than the leaves, firm, terete, bracteate; sterile and fertile bracts small, deltoid, apiculate; pedicels up to 6 mm long, articulated in the middle. *Flowers* many, laxly arranged on rachis, 2–4 nate; perianth segments 1 cm long; filaments probably glabrous, shrivelling unevenly when dry, anthers typical; ovary with 10–12 ovules per cell. *Capsule* not seen.

Flowering Period: December.

DISTRIBUTION: Probably from eastern Cape.

CAPE.—Queenstown: Gwatyn farm, mountain sides, Galpin 8333 (PRE, neo.).

The species is closely related to *C. comosum* but the leaves are narrower and firmer and the ovary has 10–12 ovules per cell. The leaves do not make an elongated rosette as in *C. capense*. The filaments are described as retrorsely papillate; those on the Galpin specimen appear to have been glabrous, but have shrivelled irregularly. Our specimen is taller, but otherwise agrees with the description of the type.

8. *C. comosum* (Thunb.) Jacques, Journ. de la Soc. Imp. et Centr. d'Hortic. 8: 345 (1862); Bak. in J. Linn. Soc. 15: 329 (1876) and in Fl. Cap. 5: 400 (1897); Wood



in Natal Plants 3: 279 (1902); Adamson & Salter in Flora of the Cape Peninsula, 185 (1950); Watt & van Brandwyk in the Medicinal and Poisonous Plants of Southern Africa, 13 (1932).

*Anthericum comosum* Thunb. Prod. 63 (1794), and in Fl. Cap. ed. Schultes 323 (1823); Roem. & Schult., Syst. Veg. 7: 475 (1829). Type: Cape, Uniondale, Langekloof Thunberg (UPS, holo., PRE, photo.). ? *A. sternbergianum* Roem. & Schult., Syst. Veg. 7: 1693 (1829). Type: apparently described from a plate and description made by Sternberg who named it *C. comosum*. Neither the plant nor the plate could be found. *A. planifolium* Thunb. a and c, nom. tant. ex Juel in Plant. Thunb. 121 (1918), (UPS, PRE, photo.).\*

*Phalangium comosum* (Thunb.) Poir. in Lam. Encyc. 5: 252 (1804). *P. viviparum* Hort., Bak. in Fl. Cap. 6: 400 (1897).

*Chlorophytum burchellii* Bak. in J. Linn. Soc. 15: 330 (1876). *C. elatum* var. *burchellii* Bak. in Fl. Cap. 6: 399 (1897). Type: Cape: Albany, Blue Krantz, Burchell 3650 (K, holo.). *C. delagoense* Bak. in Fl. Cap. 6: 399 (1897). Type: Portuguese East Africa, Delagoa Bay, Monteiro (K, holo.). Baker thought that the raceme was part of a panicle but both Killick and Marais, who studied the type at Kew, thought it to be simple and not a branch. They could not distinguish it from *C. comosum*. *C. longituberosum* Poelln. in Bol. Soc. Brot. 2, 16: 56 (1942). Type: Natal, Scottspoor (alt. 4,000 ft.) Thode 3495 (B, holo.! PRE, photo.). I could not trace this locality. *C. vallistranpii* Poelln. in Bol. Soc. Brot. 2, 16: 79 (1942). Type: Cape, Albany, Trapp's Valley, Daly 625 (B, holo.!, GRA, iso.!).

Plants up to 80 cm high. *Roots* long, many, swollen near the tips. *Rhizome* small, vertical. *Leaves* variable, 10–30 cm long, 1–2 cm broad, tapering at the base and apex, soft, usually flat, arranged in a loose rosette. *Inflorescence* much longer than the leaves, a simple long, lax raceme, sometimes with 1–2 basal ascending branches; often the apical flowers suppressed and the bracts enlarged to form a leafy tuft; scape long, terete, bracteate; sterile bracts narrow lanceolate, 2–4 cm long, acuminate, fertile small, deltoid, subulate; pedicels thin, up to 8 mm in fruit, articulated near the middle. *Flowers* in small, spiral, bracteate, axillary fascicles, 1–6 nate; perianth with narrow segments, 1 cm long, sometimes reflexed; filaments glabrous, slightly swollen above the middle, shrinking unevenly when dry; ovary with ca. 6 ovules per cell. *Capsule* globose in outline, emarginate, 5 mm in length. *Seeds* typical, slightly convex on one side.

Flowering Period: During the summer months.

DISTRIBUTION: Found along the eastern forest areas from Swellendam to the Soutpansberg; an important constituent of the forest undergrowth; also found near streams and in moist shady places.

CAPE.—Humansdorp: Thode A 1053 (PRE). Knysna: Ashkop, Fourcade 3709 (BOL); Belvidere, Duthie 994 (BOL). George: Compton 10689, 14342 (NBG); Wilderness, Compton 15546 (NBG); Grootvadersbosch, Marloth 3493 (PRE), Zeyher 4236 (NBG). Port Elizabeth: Loerie, Dix 183 (GRA). Queenstown: Gwatyn, Galpin 8192 (PRE); Katberg, near Sanatorium, Schönland 4323 (GRA). Komgha: Flanagan 2248 (PRE, BOL, NBG, GRA). Kentani: Pegler 1171 (PRE, BOL).

NATAL.—Bergville: Mont aux Sources, Bayer & McLean 109 (PRE). Estcourt: Cathkin Park, Ndema Forest, Galpin (PRE, 11760). Durban: Berea, Forbes 819 (NH). Zululand: Eshowe Bush, Gerstner (NH 22596), Lawn 110 (NH).

TRANSVAAL.—Pietersburg: Woodbush, Pott 4790 (PRE), Codd 9415 (PRE). Soutpansberg: Entabeni, Obermeyer 901 (PRE).

PORTUGUESE EAST AFRICA.—Delagoa Bay, Monteiro (K).

\* Add to synonymy: *Hartwegia comosa* Nees in Nova Acta 15, 2, 373 (1831); Kunth, Enum. 4: 607 (1843).

*Caesia comosa* (Thunb.) Spreng. Syst. 2: 88 (1825); Kunth l.c. 610.

Characteristic of this species are the leafy tufts at the apices of the racemes. These bend down to earth because of their weight and take root. In this way they multiply very rapidly and cover vast stretches in the undergrowth of the eastern Cape forests. The plants however do not always produce these leafy rosettes. Those seen from the northern Transvaal never had them. Adamson records it from the Cape Peninsula as "not more than a garden escape". It is used as a purgative by the Xhosas.

This plant and the variety mentioned below are well known cultivated stoep plants in South Africa, known as "Hen and Chickens". It is also well known in Europe where for many years the variety with a broad yellow band on each side of the midrib of the leaf has been a popular pot plant called *C. variegatum* (Fl. Mag. 1875, t.152). It is often mistakenly called *C. capense* or *C. elatum* [cf. Gérôme, Nouvelles Précisions sur les Variétés Panachées et sur les Caractères Distinctifs entre *C. elatum* et *C. comosum*, in J. Soc. Nat. Hort. France, 28: 98 (1927)]. In America it is called the Bracket plant or Spider plant. In Bailey 9: 29 (1961) Dress has written an article on the species of *Chlorophytum* in cultivation in America, their descriptions and a key. He doubts whether the cultivated plants which there bear the names *C. capense* and *C. comosum* are really different. As I have not seen the larger and broader leaved plant which they call "*C. capense*", I cannot give an opinion on it. In South Africa *C. comosum* may bear leafy tufts or not and the leaves of the wild plants are usually longer and broader than those of the cultivated specimens. True *C. capense* is rather rare and never cultivated. Lawrence in Gentes Herbarium 8: 11 (1949) wrongly applied the name *C. capense* (L) Kuntze to *C. comosum*.

9. *C. bowkeri* Bak. in Ref. Bot. t. 352 (1873); in J. Linn. Soc. 15: 332 (1876) et in Fl. Cap. 6: 398 (1897). Type: Probably from the eastern Cape, *Bowker* (K, holo.). Described and drawn from a living plant.

*C. stamineum* Zahlbr. in Ann. Nat. Hofmus. Wien 15, 1: 18 (1900), with figure in text e descr. Type: Cape: Griqualand East, *Krook* (Pl. Penth. 510; W, holo., destroyed). *C. strictum* Bak. in Bull. Herb. Boiss. Ser. II, 1: 782 (1901). Type: Transvaal, Middelburg, Elandspruitberge, *Schlechter* 3831 (Z, holo., PRE, photo.). *C. nigricans* Bak. Bull. Herb. Boiss. Ser. 2, 4: 997 (1904). Type: Transvaal, Johannesburg, Modderfontein, *Conrath* 666 (Z, holo., PRE, photo, GZU, iso.). *C. wilmsii* Engl. & Krause in Engl. Bot. Jahrb. 45: 138 (1910). Type: Transvaal, Lydenburg, near the town, *Wilms* 1522 (B, holo., probably destroyed, K, iso., PRE, photo.). *C. perlongibracteatum* Poelln. in Port. Acta Biol. 1: 229 (1945) e descr. Type: Natal, Scottspoor, *Thode*, 3496 (B, holo., probably destroyed). This locality could not be traced.

Plants glabrous, gregarious, up to 1 m high. *Roots* typical. *Rhizome* small, woody. *Leaves* many, rosulate, linear to lanceolate, 30–60 cm long, 2–6 cm broad, semi-folded, somewhat undulate, slightly narrowed to the clasping base, attenuate in upper half. *Inflorescence* simple, seldom with a basal branch, up to 100 cm high, with many flowers closely arranged and supported by large bracts, hiding the rhachis; scape terete, firm, ca. 40 cm long with some large, sterile bracts; fertile bracts lanceolate, subulate, up to 2 cm long, upper usually smaller, caducous or persistent; pedicels 2–4 nate, up to 6 mm long, articulated near the base, erect. *Flowers* 2–4 nate; perianth with segments 1 cm long, rotate; filaments smooth; ovary with ca. 15 ovules per cell, style declinate. *Capsule* oblong, 11 mm long, 7 mm broad, firm. *Seeds* typical.

Flowering Period: November–March, usually in the spring.

DISTRIBUTION: Eastern Cape, Natal, Swaziland, Transvaal, Bechuanaland, Southern Rhodesia; often in damp situations or in grassveld.

CAPE.—King William's Town: Hogsback Mountain, *Rattray* 363, *Sim* 1099, 20293 (PRE, BOL). Stutterheim: Evelyn Valley, *Leighton* 2678 (BOL); Stutterheim commonage, *Acocks* 9540 (PRE). East London: *Wormald* 21 (GRA). Kentani: *Pegler* 1172 (BOL, PRE). Komgha: near Komgha, grassy hills, *Flanagan* 568 (PRE).

NATAL.—Weenen: Estcourt Research Station, *Acocks* 10753 (PRE). Inanda: *Wood* 1228 (NH). Klipriver: van Reenen's Pass, *Schweickerdt* 951 (PRE).

SWAZILAND.—Near Forbes Reef, *Codd* and *Muller* 316 (PRE).

TRANSVAAL.—Barberton: Rimer's Creek, *Galpin* 1204 (PRE). Pilgrim's Rest: Kowyn's Pass, *Codd* 6449; 7040 (PRE). Belfast: *Leendertz* (TM 10132, PRE); Machadodorp, *Galpin* 13006 (PRE); Lydenburg, *Smuts & Gillett* 2491 (PRE). Bronkhorstspuit: Rhenosterkop, *Young* 2133 (PRE). Pretoria: *Mogg* 15911 (PRE). Potchefstroom: *Louw* 1301 (PRE). Waterberg: below Krantzberg, *Dyer & Erens* 4205 (PRE). Marico: Lekkerlach, *Louw* 806 (PRE). Potgietersrus: Kwarriehoek, *Steyn* 83 (PRE). Pietersburg: Chuniespoort, *Mogg & Barnard* 1165 (PRE). Soutpansberg: Elim, *Obermeyer* TM 29327 (PRE).

BECHUANALAND.—Lobatsi, *Rogers* (BOL).

SOUTHERN RHODESIA.—Salisbury, *Eyles* 2081 (PRE).

The typical plant (cultivated) had wide leaves; those from moist areas also have them but some from around Pretoria and several other localities have a much narrower lamina, a xerophytic adaptation. The very long, subulate bracts and the flowers congested on the simple raceme are typical for the species. Although there are usually about 15 ovules per cell, the type plant was said to have 20–30 ovules. The doubling of one or both rows of ovules occasionally occurs.

*C. magnificum* Weimarck from Southern Rhodesia seems to be a wide-leaved luxuriant form of *C. bowkeri*.

10. *C. trachycarpum* Oberm. sp. nov. *C. brachystachyo* Bak. affine sed ita differt: capsulae tuberculatae minores. Fig. 3.

*Radices* tenues apice tuberiferae. *Folia* oblongo-lanceolata plana tenuia marginibus fimbriatis. *Racemus* simplex circ. foliis aequalis; scapus teres saepe nudus; flores congesti; bractae ovatae abrupte aristatae; pedicelli breves sub fructu ad 5 mm longi ad apicem articulati. *Perianthii* segmenta 1 cm longa; filamenta glabra; ovarium papillatum sulcatum. *Capsula* parva, lata irregulariter tuberculata.

Plants up to 40 cm high, gregarious. *Roots* many, thin, wiry, with tuberous swellings near the tips. *Rhizome* compact, small. *Leaves* oblong-lanceolate, up to 40 cm long, 5 cm broad, attenuate below and above, flat, thin, striate, margin crisped, fimbriate: outer primary leaves much smaller. *Inflorescence* simple, shorter or somewhat longer than the leaves; scape terete, erect, usually bare, flowers closely arranged on rhachis; bracts broad, suddenly narrowed into a soft, long, ciliate awn; pedicels short, up to 5 mm in fruit, articulated below apex. *Flowers* 3–5 nate; perianth-segments ca. 1 cm long; stamens with smooth filaments; ovary globose, with ca. 7 deep, transverse and 6 vertical grooves, raised areas pulvinate, papillate; 6 ovules per cell, style, exserted. *Capsule* trigonous, 3 mm high, 5 mm broad, with rough, tuberculate, transverse ridges, seldom nearly smooth. *Seeds* typical,  $1\frac{1}{2}$  mm in diam. ca. 2 per cell.

Flowering Period: December–January.

DISTRIBUTION: Northern South West Africa, Southern and Northern Rhodesia in the West; a shade plant usually found near rivers.

SOUTH WEST AFRICA.—Okavango Native Territory: between Sambiu and Masari, *de Winter* 4081 (PRE, holo.).

SOUTHERN RHODESIA.—Lomagundi: Urungwe, Mensa Pan near Chirundu bridge, *Drummond* 5372 (SRGH). Darwin: Umvukwes, Umsengedzi River, *Wild* 3980 (SRGH). Wankie: 40 miles south of Wankie, *Wild* 4748 (SRGH).

NORTHERN RHODESIA.—Mazabuka, Kandabwe River Dam, *Robinson* 1790 (SRGH); near Chirundu bridge, *Drummond* 5415 (SRGH).





FIG. 3.—*Chlorophytum trachycarpum* Oberm. a, habit showing tuberous root swellings,  $\times \frac{1}{2}$ . b, flower,  $\times 2$ . c, leaf margin, much enlarged. d, capsule,  $\times 4$ .



The species is related to *C. brachystachyum* Bak. but it has a papillate ovary, a small broad tuberculate capsule and thin roots with scattered tubers. The type of *C. brachystachyum*, unfortunately, is incomplete consisting only of 2 small, fimbriate leaves ca. 11 cm long, 1.5–2 cm wide. For the rest we have Baker's description made from a living plant sent by Buchanan from Nyasaland. He describes the roots as cylindrical, fleshy and the raceme branched at the base but he does not mention the ovary or capsule. I therefore think that the ovary must have been smooth, otherwise he would have remarked on it. In the Salisbury Herbarium is a specimen from Zomba in Nyasaland (*Banda* 360) which I think is true *C. brachystachyum*; it has firm roots, fimbriate leaves and lanceolate, ciliated bracts; it has a smooth, oblong ovary. *West* 3776 from Inyanga, Southern Rhodesia could also belong to Baker's species. An unusual feature in *C. trachycarpum* is that the articulation of the pedicel is just below the perianth.

11. *C. papillosum* Rendle in J. Linn. Soc. 30: 422 (1895). Type: East Africa, Tanganyika, between the coast and Uyui, *Taylor* (BM, holo., PRE, photo.).

*C. dolomiticum* Dinter in Neue Pfl. Deutsch-Südwest Afr. 23 (1914). Type: South West Africa, Tsumeb, *Dinter* 2703 (NBG, iso.). *C. tsumebensis* Dinter in Bot. Jahrb. 57: 237 (1921). Type: South West Africa, Tsumeb, *Dinter* 2703 (B, holo., PRE, photo., NBG, iso.).

*Dasytachys papillosa* (Rendle) Bak. in Fl. Trop. Afr. 7: 514 (1898).

*Anthericum lunatum* Poelln. in Fedde, Rep. 52: 259 (1943). Type: South West Africa, Outjo, *Dinter* 1398 (B, holo., PRE, photo.). Fig. 4.

Plants up to 80 cm high. *Roots* long, many, hard and fibrous when old, younger parts soft and fleshy. *Rhizome* small, compact, horizontal, fibrous. *Leaves* many, in an elongated rosette, linear to lanceolate, ca. 40 cm long, 2.5 cm wide, soft, glabrous, shiny, half-folded, margin undulate, ciliate. *Inflorescence* simple or seldom with an ascending branch below, exceeding the leaves; scape terete, glabrous below, glandular-papillate above, bracteate; bracts 5–2 cm, linear-subulate, ciliate; pedicels short up to 5 mm in fruit, not articulated. *Flowers* ca. 5-nate, congested on the raceme, perianth white, glandular-papillate, globose at the base, constricted near the middle, with the segments slightly spreading, 1 cm long, apex of segments green tipped; filaments glabrous, lengthening when the flower opens and ultimately much exerted, up to 12 mm long; ovary trisulcate, placed on a small disk with 10–14 ovules per cell; style exerted declinate; stigma capitate, minute. *Capsule* oblong, trigonous, green, shiny, 1 cm long, shortly stipitate. *Seeds* 4 mm in diam.

Flowering Period: January–April.

DISTRIBUTION: Tanganyika, Southern Rhodesia, northern South West Africa; a shade plant.

SOUTH WEST AFRICA.—Outjo: Narebis, *Barnard* 182 (NBG). Okavango: Mohembo, *de Winter* 4404 (PRE). Kaokoveld: near Kaoko Otavi, *de Winter & Leistner* 5545 (PRE).

BECHUANALAND.—Ngamiland, *Curson* 555 (PRE).

SOUTHERN RHODESIA.—Bulawayo: *Brain* 5048 (SRGH). Ndanga: Triangle, *Wild* 3722 (SRGH).

The wild specimens are glanduliferous but in cultivation in Pretoria this character disappeared, the plants becoming very luxuriant and growing to twice their usual size.

12. *C. rigidum* Kunth, Enum. 4: 604 (1843). Type: Cape, Tulbagh, Great Winterhoek, *Drège* 8738 (K, holo., PRE, photo.).



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FIG. 4.—*Chlorophytum papillosum* Rendle. a, habit,  $\times \frac{1}{3}$ . b, outer and inner bracts. c, cross-section of capsule. d, capsules. e, papillate flower with globose base, exserted stamens and style  $\times 2$ . f, flat black seed with cuneate funicle,  $\times 5$ .

*Anthericum rigidum* (Kunth) Bak. in J. Bot. 10: 141 (1872) et in Fl. Cap. 6: 381 (1896). *A. schultesii* sensu Bak. in J. Linn. Soc. 15: 315 (1876) et in Fl. Cap. 385 (1897); sensu Duthie in Ann. Univ. of Stell. 4, 1: 17, t. 6 (1926). Baker, who had not seen the type of *Chlorophytum dubium* Roem. & Schult. (which was given the name *Trachyandra schultesii* by Kunth, when he transferred it to his new genus), quoted specimens under *A. schultesii* in the Fl. Cap., which should have come under *C. rigidum*. [*Chlorophytum dubium* is a synonym of *Chlorophytum triflorum* (Ait.) Kunth.].

Plants up to 50 cm high. *Roots* wiry with age, soft and fleshy when young. *Rhizome* small, horizontal or inclined, often covered with fibres of old leaf bases. *Leaves* more or less distichous, variable, up to 30 cm long, 8 mm wide, glabrous, folded or flat, somewhat rigid; primary leaves short, falcate. *Inflorescence* with a few branches up to 50 cm high; scape firm, terete with a few small bracts; fertile bracts in small 10-ulate clusters, dark ovate; pedicels up to 1 cm in fruit, articulated near the base. *Flowers* 3-6 nate; perianth variable in size, 25-35 mm in diam. white with a 5-nerved brown keel; filaments slender, scabrid; ovary with 6-15 ovules per cell.\* *Capsule* trigonous with transverse, rugose ridges. *Seeds* 3 mm in diam.

Flowering Period: May-October.

DISTRIBUTION: Cape: Caledon, Somerset West, Stellenbosch, Paarl and Tulbagh districts.

CAPE.—Caledon: lower S. slopes of French Hoek Mts. (Gem Pk), *Esterhuysen* 11426 (BOL). Somerset West: Sir Lowry's Pass, *Bolus* 5560 (BOL); Villiersdorp, *Bolus* 5268 (BOL); Gordon's Bay, *Guthrie* (BOL 25718). Stellenbosch: Jonkershoek, *Compton* 15291 (NBG). Paarl: Wemmershoek, *Compton* 20196 (NBG); Hercules Pillar, *Barker* 4854 (NBG); Bainskloof, *Bolus* 4071 (BOL). Tulbagh: Ontongberg, *Leighton* (BOL 24289).

The specimens from Sir Lowry's Pass, *Bolus* 5560 and Gordon's Bay, *Guthrie* in herb. Bolus 25718, are larger than the type specimen but otherwise agree.

13. *C. monophyllum* Oberm. sp. nov. *C. rigido* Kunth affine, sed monophyllo differt.

*Planta* ad 50 cm alta. *Rhizoma* non visa. *Folium* solitarium angustissimum ad 40 cm longum 2 mm latum complanatum rigidum glabrum basi dilatatum. *Racemus* ramosus divaricatus; scapus teres glabrus; bractae minores fuscae, bractae fertiles fasciculatae; pedicelli sub fructu ad 1 cm longi prope basin articulati. *Segmenta* perianthii rotata vel reflexa 1 cm longa; filamenta scabra; ovula in quoque loculo circ. 10. *Capsula* 7 mm alta transverse costata.

Plants up to 50 cm. *Roots* not seen. *Rhizome* not seen. *Leaf* 1, linear, 40 cm long, 2 mm broad, folded, rigid, glabrous, broadened at the very base. *Inflorescence* a much branched divaricate panicle; scape terete, glabrous, about as long as the raceme, with a small dark bract; branches elongate, congested above; fertile bracts minute, deltoid, clustered; pedicels short in bud, up to 1 cm in fruit, articulating near the base. *Flowers* laxly arranged in upper part; perianth with spreading or reflexed segments, 1 cm long; filaments slender, scabrid; ovary with ca. 10 ovules per cell. *Capsule* typical, 7 mm high, with transverse ridges. *Seeds* immature.

Flowering Period: December.

DISTRIBUTION: Only known from the type locality.

CAPE.—Ceres: Cold Bokkeveld, sandflats, *Adamson* D9 (PRE, holo., BOL, iso).

The species is closely allied to *C. rigidum* but Adamson noted that it had only one leaf, which moreover is much narrower. It will be interesting to see more material of this species.

\* Kunth found 6 ovules per cell, while I counted up to 15.

14. *C. viscosum* Kunth, Enum. 4: 605 (1843). Type: Cape, Namaqualand, near the mouth of the Orange River, Drège 2673 (B, holo., L, K, iso., PRE, photo.). *Anthericum viscosum* (Kunth) Bak. in J. Bot. 10: 141 (1872) in J. Linn. Soc. Bot. 15: 316 (1876) et in Fl. Cap. 6: 387 (1897). Dur. & Schinz, Consp. Fl. Afr. 5: 387 (1893). Poelln. in Fedde, Rep. 52: 243 (1943). *A. kovismontanum* Dint. in Fedde, Rep. 29: 268 (1931). Type: South West Africa, Kavis mountains, Dinter 6645 (B, holo., PRE, photo.). *A. longibracteatum* Dinter in Fedde, Rep. 29: 267 (1931); Poelln. in Fedde, Rep. 52: 240 (1943) including var. *brevibracteatum* l.c. and including forma *submembranaceum* Poelln. in Fedde, Rep. 52: 244 (1943). Type: South West Africa; Diamond Area II; Pomona, Dinter s.n. 2nd June 1929 (B, holo., M, iso., PRE, photo.). Type of var.: South West Africa: Diamond Area I: Halenberg, dunes, Dinter 4066 (B holo! PRE, photo.).

Gregarious plants hard in texture, up to 60 cm high (usually smaller in the Namib) with all parts glandular; glands shortly stipitate. *Roots* many, uniform, pinkish, slightly swollen, 3 mm in diam. hollow when dry, the soft mesoderm having shrunk. *Rhizome* short, horizontal, covered with old, hard leaf-bases which may eventually disintegrate into fibres. *Leaves* distichous or rosulate, variable in size, 15–35 cm long, 2–10 mm broad, dilated at the clasping base, flat, closely ribbed, glandular, hard; primary outer leaves ca. 2 cm long, pale, membranous. *Inflorescence* simple or laxly branched, shorter or longer than the leaves; scape glandular with a few small bracts; fertile bracts small, membranous; pedicels short at first, up to 11 mm in fruit, articulated near the base. *Flowers* laxly arranged, ca. 4-nate; perianth spreading, white, dark keeled, segments ca. 8 mm long; filaments scabrous; ovary with ca. 19 ovules per cell. *Capsule* ovoid, apiculate, trigonous, closely transversely ribbed. *Seeds* flat.

Flowering Period: June–October.

**DISTRIBUTION:** South western Cape, recorded from the Piketberg, Vanrhynsdorp, Calvinia and Namaqualand districts, to the southern part of South West Africa. Usually in sand; noted to be fairly frequent where found.

**CAPE.**—Piketberg: sandy slope between Verloren Vlei and Rooikransberg, Pillans 7849 (BOL). Clanwilliam: near Clanwilliam, sandy arid fynbos, Acocks 19762 (PRE). Vanrhynsdorp: Zandkraal, marginal strandveld, Acocks 15165 (PRE). Calvinia: Lokenburg, Acocks 17391 (PRE). Namaqualand: Witbank, Pillans 5145 (B).

**SOUTH WEST AFRICA.**—Diamond Area I: Klinghardt Mountains, Dinter 4048 (PRE, B). Luederitz: Rheinpfalz, Dinter 6376 (B); Peilberg, Buchu Mountains, Dinter 6507 (B); Kavis Mts. Dinter 6291 (B).

The plants are variable in size, due no doubt to surroundings; those from more favourable localities grow up to 60 cm high, whereas those from the Namib remain stunted, seldom over 15 cm high. The pink, uniform roots and glandular covering allow for easy recognition of the species.

15. *C. triflorum* (Ait.) Kunth, Enum. 4: 606 (1843); Adamson & Salter, Flora of the Cape Peninsula, 185 (1950).

*Anthericum triflorum* Ait. in Hort. Kew 1: 448 (1789); Willd. Spec. Plant. 2: 140 (1799); Roem. & Schult., Syst. Veg. 7: 466 (1829); Bak. in Fl. Cap. 6: 383 (1896); Duthie in Ann. Univ. Stell. 4: 18 (1926). Type: ex hortus Kew (BM, holo., PRE, photo.). Introduced in 1782 by George Wench. *A. pauciflorum* Thunb., Prod. 63 (1794); and in Fl. Cap. ed. Schultes 320 (1823). Type: Cape, Lion Mountain, and in the Swartland, Thunberg a (UPS, holo., PRE, photo.). *A. bipedunculatum* Jacq., Coll. Suppl. 88: 10; Icones 2: 18, t. 410 (1795). Type: Plate 410, l.c. No specimen preserved. *A. dubium* (Roem. & Schult.) Poelln. in Fedde, Rep. 50: 232 (1941).

*Phalangium bipedunculatum* Poir. in Lam. Encyc. 5: 244 (1804). *P. pedunculatum* Bak. in error for *P. bipedunculatum* Poir. in J. Linn. Soc. 15: 315 (1876). *P. triflorum* (Ait.) Pers., Synops. 1: 368 (1805).



*Chlorophytum dubium* Roem. & Schult., Syst. Veg. 7: 455 (1829). Type: Cape (M, holo., PRE, photo.). There is no locality or collector noted on the label, only a number 1624. *C. brehmeanum* Roem. & Schult., Syst. Veg. 7: 454 (1829) e descr. Type: Cape, *Brehm* (the type could not be located).

*Trachyandra? brehmeana* (Roem. & Schult.) Kunth, Enum. 4: 586 (1843). \* *T. pauciflora* (Thunb.) Kunth, Enum. 4: 584 (1843). *T. schultesii* Kunth, Enum. 4: 586 (1843). [Kunth changed the epithet of *Chlorophytum dubium* Roem. & Schult., to *schultesii* when he transferred it. The specimens quoted by Baker under *Anthericum schultesii* in the Fl. Cap. belong to *Chlorophytum rigidum*].

Plants sturdy, up to 1 m high. *Roots* many thick, hard, dark, swollen above, tapering gradually to the tip. *Rhizome* small, compact, horizontal, with a few fibres from old leaf bases. *Leaves* rosulate, variable in size, linear-lanceolate, up to 25 cm long, 2 cm wide, long tapered in upper half, clasping at the base, folded or flat, soft, striate, glabrous. *Inflorescence* a simple raceme, seldom with a short, basal, ascending branch; scape firm, terete, bracteate; bracts diminishing in size, upper subulate, dark keeled, with a membranous edge; pedicels short at first, up to 14 mm in fruit, articulated just above the middle. *Flowers* 2-4 nate; perianth white, thin, reddish brown on the outside, segments 10-12 mm, spreading or reflexed; filaments scabrid; ovary with 11-17 ovules per cell. *Capsule* typical, ca. 2 cm long, 12 mm wide. *Seeds* typical, 4 mm in diam.

Flowering Period: July-October.

DISTRIBUTION: South western Cape; in crevices on mountain slopes or in sand. CAPE.—Wynberg: Sea Point, above Bantry Bay, *Smith* 2883, 2932 (PRE); Green Point, *Pappe* (NBG 22905); Cape Town, *Rogers* 2469 (GRA), *Wolley-Dod* 2778 (BOL); Salt River, *Zeyher* 4659 (NBG); Melkbosch Strand, *Esterhuysen* 2842 (BOL). Malmesbury: Mamre Hills, *Wasserfall* 450 (NBG, PRE), *Compton* 21663 (NBG); near Darling, *Esterhuysen* 3875 (NBG, BOL). Piketberg: between Verloren Vlei and Rooikransberg, *Pillans* 8080 (BOL).

It is one of the oldest *Chlorophytum* species from the Cape known to be cultivated in Europe. The roots are very typical and distinguish it from all other species.

16. *C. namaquense* Schltr. ex Poelln. in Ber. Deutsche Bot. Ges. 61: 207 (1943). Type: Cape, Namaqualand, Vogelklip, *Schlechter* 11295 (B, holo., probably destroyed, PRE, iso.).

*C. marlothii* Poelln. in Port Acta Biol. 1: 229 (1945). Type: Namaqualand, Anenous, *Marloth* 12218 (B, holo., probably destroyed, PRE, iso.). *C. inornatum* sensu Bak. in Fl. Cap. 6: 399 (1897); non Gawler.

Fairly large plants, up to 80 cm high. *Roots* many, probably soft and spongy when young, woody and ca. 2 mm thick when old. *Rhizome* small, covered with fibres from old leaf bases. *Leaves* in an elongated rosette, lanceolate, long tapered in upper half, clasping at the base, up to 40 cm long, 25 mm broad, flat, glabrous, margin minutely ciliate. *Inflorescence* simple or with 1-2 ascending branches, 40-80 cm high, much exceeding the leaves; scape glabrous, stout, up to 5 mm in diam. bracteate, the bracts diminishing in size, fertile bracts ca. 5 mm acuminate; pedicels short at first, 1 cm long in fruit, articulated in the middle. *Flowers* 2-4 nate; perianth white, with a dark keel, segments rotate, 12 mm long; filaments scabrid; ovary with ca. 20 ovules per cell. *Capsule* typical, sutures prominent, 15 mm long, 7 mm broad. *Seeds* typical, 3 mm in diam.

Flowering Period: August-September.

DISTRIBUTION: Cape: known only from Namaqualand, apparently rare.

CAPE.—Namaqualand: Mesklip, *Barker* 1883 (NBG), *Compton* 5869 (NBG); Modderfontein, *Bohus* 6585 (BOL.).

\* In J. Bot. Lond. 10: 139 (1872) Baker refers it to *Anthericum brehmeanum*.

Baker in the Fl. Cap. 6: 399 (1897) refers *Bolus* 6585 from Modderfontein, Namaqualand, to *C. inornatum* Gawler from Sierra Leone but this species has a flat rosette with soft leaves, only 2-5 seeds per loculus and a scabrid, villous scape. The difference in localities moreover makes it unlikely that they could be conspecific.

17. *C. undulatum* (Jacq.) Oberm. comb. nov.

*Anthericum undulatum* Jacq., Coll. Suppl. 68, 10; Icones 2: 18, t. 411 (1793). Bak. in J. Linn. Soc. 15: 304 (1876); and in Fl. Cap. 6: 380 (1876). Type: Plate 411, l.c. No specimen preserved.

*A. graminifolium* Willd., Sp. Plant. 2: 139 (1799) nom. nov. for *A. undulatum* Jacq. (1793); non Thunb. (1794); Roem. & Schult. in Syst. Veg. 7: 463 (1829). [Thunberg's *A. undulatum*, a synonym of *Trachyandra hispida* (L.) Kunth, was published in his Prodomus, which appeared in 1794, so that Jacquin's name remains valid]. *A. bolusii* Bak. in Fl. Cap. 6: 385 (1897). Type: Cape, Namaqualand, *Bolus* 6601 (K, holo., BOL, iso.!). *A. pauciflorum* Thunb. var.  $\beta$ , *minor* Bak. in J. Linn. Soc. 15: 315 (1876); *A. triflorum* Ait. var.  $\beta$  *minor* Bak. in Fl. Cap. 6: 383 (1897). Type of var.: Cape, Paarl, between Paarl and Lady Grey Railway Bridge, *Drege* 8723 a (L, iso.!, PRE, photo.). (*Galpin* 1025 from near Barberton, Transvaal, quoted in Flora Cap. 6: 383, is *Anthericum cooperi* Bak.). *A. tumidum* Poelln. in Bol. Soc. Brot. 16, 2: 77 (1942). Type: Cape Piketberg, *Diels* 191 (B, holo.!, PRE, photo.). *A. pleiophyllum* Schlechter ex. Poelln. in Fedde, Rep. 53: 6 (1944). Type: Cape, Namaqualand, *Schlechter* 11277 (B, holo.!, PRE, iso.!). *A. dielsii* Poelln. in Fedde, Rep. 53: 127 (1944). Type: Cape, Clanwilliam, Olifantsdal, *Diels* 366 (B, holo.!, PRE, photo.).

*Phalangium undulatum* (Jacq.) Poir. in Lam. Encycl. 5: 242 (1804).

*Chlorophytum graminifolium* (Willd.) Kunth, Enum. 4: 606 (1843). *C. tuberculatum* Duthie in Ann. Stell. Univ. 4: 15, t. 7 (1926). Type: Cape, Stellenbosch, Flats, *Duthie* 992 (STE, holo., BOL, iso.!). *C. piquetbergense* Poelln. in Port. Act. Biol. 1: 230 (1945). Type: Cape, Piketberg, Nieuwe Kloof, *Diels* 194 (B, holo.!, PRE, photo.).

Plants variable in size, up to 50 cm high. *Roots* many, covered with a soft mesoderm when young and then ca. 2 mm in diam., the soft parts disappearing with age, leaving the wiry, hard, inner core, sometimes the root tips swollen; short sessile "tubers" (arrested roots) often present on rhizome between fibres of old leaf bases. *Rhizome* small, horizontal, covered with fibres of old leaf bases. *Leaves* forming more or less flat rosettes, very variable in size and appearance, linear to lanceolate, 5-20 cm long, 2-10 mm wide, tapered to the apex, attenuate to the base if lamina is wide, extended near the base if it is narrow, erect or spirally twisted, flat or folded, margin straight or crisped, ciliate; outer primary leaves absent or present as ligulate bracts up to 4 cm by 1 cm, spotted with red. *Inflorescence* a simple raceme, seldom with a basal ascending branch; scape terete, firm, bracteate, fertile bracts membranous, resembling the perianth; pedicels short at first, 14 mm long in fruit, articulated near the middle. *Flowers* fairly close together, 2-4 nate; perianth white, with a dark, often wine-red keel, spreading or reflexed, segments 8-15 mm long; filaments scabrid; ovary with ca. 12 ovules per cell, style declinate, stigma small, penicillate. *Capsule* oblong, 12 mm long, 8 mm broad emarginate, sutures prominent. *Seeds* typical, 3 mm in diam.

Flowering Period: July-October.

DISTRIBUTION: South western Cape districts, common.

CAPE.—Stellenbosch: Faure, *Strey* 516 (PRE). Bellville: north of Tygerberg, *Compton* 20056 (NBG). Hopefield: *Salter* 3031 (BOL). Malmesbury: near Vredenburg, *Leighton* 588 (BOL, PRE). Tulbagh: *Zeyher* 28 (NBG). Paarl: Hercules Pillar, *Barker* 1822 (NBG). Piketberg: de Hoek, *Esterhuysen* 5518 (BOL). Clanwilliam: near Doorn River Bridge, *Barker* 6554 (NBG); Bidouw Berg, *Schlechter* 8687 (PRE). Vanrhynsdorp: sandveld, *Marloth* 8270 (PRE). Calvinia: Perdefontein, *Acocks*

17310 (PRE); Lokenburg, *Acocks* 18908 (PRE). Namaqualand: Springbok, *Acocks* 19433 (PRE). Ceres: Spes Bona, *Marloth* 10366 (PRE). Laingsburg: Matjiesfontein, *Acocks* 17145 (PRE). Prince Albert: *Marchand* in herb. *Marloth* 10510, (PRE).

*Anthericum undulatum* figured and described by Jacquin was said to have come from the Cape but Baker in the *Flora Capensis* could not place any specimens under this species. When, however, a plant collected at Lokenburg in the Calvinia district, flowered at the Division of Botany, its resemblance to the Jacquin plate was very striking. As it is a very common Cape species, although variable and therefore given many names, it is likely that Jacquin had received seeds or plants from this species. The flowers were painted singly by Jacquin but it is seen occasionally that the subsequent buds can be absent or very small. He also described the filaments as glabrous but those of *A. bipedunculatum* on the previous plate and *A. "flexuosum"* on the following, were also called glabrous by him which in fact they are not but the small papillae on the filaments are easily overlooked. It was suggested that the plate represented *A. liliago* L. from North Africa, but this species has an ovoid, pointed ovary whereas Jacquin described it in his species as "subrotundum, triquetrum". Jacquin's plant moreover flowered in October, which is the flowering time for the Cape species, whereas *A. liliago* from North Africa flowers in May. *Acocks* commented on the variability of *C. undulatum* as follows: "My feeling is that all these *Chlorophytums* are a single species no matter whether they have short, narrow straight leaves with straight, undulate or crenulate margins, or broad, folded, arcuate leaves, long or short, straight edged, undulate or crisped; no tubers, few or many, thin or fat; short inflorescence or long; so much depends on where they grow, whether in deep, sandy soil, near a water course, or on heavy soil, or on next to no soil in the crevices of shale and on whether they have had lots of well distributed rain, no rain, or intermittent rain with droughts in between; and on how many times they were eaten off, before they managed to come into flower; not to mention of course whether they were growing in shady places, in dense scrub or in bare exposed places. If a plant is obstinate enough to be a perennial in those parts it has to be tough and adaptable".

It was seen that the root-tubers were young roots arrested in their development; under moist conditions they elongate to become normal roots. In optimal surroundings they are absent. Jacquin described the three inner segments as undulate, and these suggested the name, but it is a rather obscure character, difficult to see in dried flowers.

18. *C. crassinerve* (Bak.) Oberm., comb. nov.

*Anthericum crassinerve* Bak. in J. Bot. 29, 71 (1891) et in Fl. Cap. 6: 384 (1896). Type: Cape: Namaqualand, near Ookiep, *Bolus* 6600 (BOL, syn.!, K, iso.); *Scully* 114 (BOL, syn.!).

Glabrous plants up to 40 cm high. *Roots* spongy, when young, thin and hard when old: short, bulbous, erect or spreading root-tubers present on rootstock between fibres. *Rhizome* compact, covered with fibres from old leaf bases. *Leaves* in a rosette, ca. 5, lanceolate, ca. 12 cm long, 14 mm broad, coriaceous, glabrous, closely ribbed, margin prominent, apex obtuse, apiculate, base attenuate; primary leaves rudimentary, membranous, mottled with purple. *Inflorescence* simple, up to 40 cm high; scape terete, firm, glabrous, spotted, bracteate; bracts membranous resembling the perianth segments, ovate, auriculate, acuminate; pedicels short at first, up to 1 cm in fruit, articulated in the middle. *Flowers* laxly arranged, 2-4 nate; perianth spreading or reflexed, segments 15 mm long, white, red keeled; filaments scabrid; ovary with ca. 15 ovules per cell. *Capsule* typical. *Seeds* typical.

Flowering Period: August-October.

DISTRIBUTION: Known only from Namaqualand.

CAPE.—Namaqualand: between Garies and Khamieskroon *Pillans* in herb. BOL. 19174; Brakdam, *Esterhuysen* 5680 (BOL); *Scully* 14 (BOL); *Morris* in herb. BOL. 19173; 6 miles N. of Garies, *Leighton* 1396 (BOL).



The species is closely allied to *C. undulatum*; the obtuse, broad leaves with the thick red margin distinguish it.

19. *C. pauciphyllum* Oberm., sp. nov. *C. undulata* (Jacq.) Oberm. affine sed foliis paucis pubescentibus differt.

*Planta* ad 15 cm alta. *Radices* plures spongiosa. *Folia* primaria brevia ligulata maculata; folium maturum unum linearis ad 45 cm longum 5 mm latum planum rigidum costatum pubescente vel glabrescente; folium novum immaturum sub anthesi pubescente. *Racemus* simplex vel basi ramo uno ad 26 cm alto; scapus gracilis teres glabrus bracteatus; pedicelli filiformes ad centrum articulati. *Segmenta* perianthii rotata 6 mm longa, filamento scabro.

Plants up to 15 cm high. *Roots* many, ca. 10 cm long, covered with a soft, spongy, lanate tissue which disappears with age leaving a hard, thin, inner core: younger roots usually spindle shaped and with several fascicled thin rootlets appearing from the tips of the swellings. *Leaves* few; primary short, ligulate, clasping the scape, purple spotted; old mature leaf (from previous season) linear, up to 45 cm long, 5 mm wide, flat, rigid, ribbed, pubescent to glabrous, margin prominent; new leaf 20 cm long at time of flowering, pubescent, clasping scape at the base. *Inflorescence* simple, 26 cm tall; scape slender, terete, glabrous with a small sterile bract; fertile bracts small, 5 mm long, membranous, pedicels filiform, articulated near the middle. *Flowers* laxly arranged, 1-2 nate; perianth rotate, 12 mm in diam. white with a green keel; filaments densely scabrous; ovary typical. *Capsule* not seen.

Flowering Period: March-September.

DISTRIBUTION: Only known from Clanwilliam in the Cape; apparently a mountain species.

CAPE.—Clanwilliam: N. of Bulshoek Barrage, *Barker* 7301 (NBG, holo., PRE, photo.). Citadelskop near Wupperthal, fairly frequent, *Leipoldt* 1071 (BOL); Nieuwoudt Pass, *Esterhuysen* 8150 (BOL).

Easily distinguished from the related species *C. undulatum* because of its solitary, long leaf, and from *C. lewisae* which has several short leaves and a bulbous rhizome.

20. *C. lewisae* Oberm., sp. nov. *C. undulato* (Jacq.) Oberm. affine sed rhizomate bulboso foliis setosis differt.

*Planta* ad 20 cm alta. *Radices* longae lanatae. *Rhizoma* bulbosa. *Folia* 2-4 ad basin et marginem setosa. *Racemus* simplex vel basi ramulo solitario; scapus pubescens bracteatus; pedicelli tenues 9 mm longi ad basin articulati. *Segmenta* perianthii reflexa 6 mm longa; filamenta scabra; ovula in loculis 12.

Small pubescent plants up to 20 cm tall. *Roots* fairly thin, the spongy tissue not much swollen, lanate. *Rhizome* bulbous, ca. 1 cm in diam. horizontal, covered with fibres of old leaf bases. *Leaves* 2-4, linear-lanceolate, up to 16 cm long, 5 mm broad, attenuate in upper half, terminating in a tiny, black, bulbous point, base slightly dilated, clasping the bulbous rhizome, upper surface glabrous, lower surface, especially the margins, setaceous. *Inflorescence* up to 25 cm tall, simple or with one short, ascending side branch; scape terete, thin, pubescent, with 1-3 small, sterile bracts; fertile bracts ovate, auriculate, 4 mm long; pedicels thin, 9 mm long, articulated below middle. *Flowers* 6-10, laxly arranged on rhachis, 2-3 nate; perianth reflexed, white with 3 dark-green nerves, segments obovate, 12 mm; filaments scabrous; ovary oblong with ca. 12 ovules. *Capsule* and seed not seen.

Flowering Period: September.

DISTRIBUTION: Cape, Calvinia.

CAPE.—Calvinia: top of Botterkloof Pass, *Lewis* (SAM 62038, holo., NBG, PRE, photo.); same locality *Johnson* 561 (NBG).

The globose rhizome and the hairy leaves distinguish it from the other species.



## SPECIES EXCLUDED

*C. vaginatum* Bak. in Fl. Cap. 6: 397 (June 1897), non Hua. Type: Natal, Weenen, Wood 4425 (K, holo., NH, iso.!).

This species was found to be identical with *ORNITHOGALUM LONGISCAPUM* Bak. in Bull. Herb. Boiss. Ser. 2, 1: 854 (1901). There is also *C. vaginatum* Hua [Contr. Fl. Congo Franç. Lil. 22 (1897)] from the French Cameroons which was published in the same year as *C. vaginatum* Bak. Professor Aubrevilles in Paris and Mr. W. Marais at Kew, were unable to discover in which month this volume appeared. As it was therefore impossible to discover which name was the older of the two, it was decided to regard Hua's name as the one published first. This makes Baker's name a synonym and so the name *Ornithogalum longiscapum* Bak. remains valid.

*C. drepanophyllum* Bak. in Fl. Cap. 6: 398 (1897). Type: Namaqualand, near Nababeep, Bolus 6584 (K, holo.). This is *Trachyandra falcata* (L.f.) Kunth.

*C. haygarthii* Wood & Evans in J. Bot. Lond. 37: 254 (1899) and in Wood's Natal Plants 1: 79 t. 98 (1899). Type: Zululand, Haygarth (Wood 7448, NH, holo.!, PRE, iso). This is *Anthericum haygarthii* (Wood et Evans) Kies, comb. nov.

*Chlorophytum norlindii* Weim. in Bot. Not. 1937: 434, photo, p. 435. Type: Southern Rhodesia, Makoni district, Maidstone, Norlindh and Weimarck 4128 (LD, holo.!, PRE, iso.!). This is *Anthericum galpinii* Bak. var. *norlindii* (Weim.) Oberm. comb. et stat. nov.

## SPECIES INSUFFICIENTLY KNOWN

*Chlorophytum leipoldtii* Poelln. in Ber. Deutsche Bot. Ges. 61: 207 (1943) by error "*C. leipoldii*." Type: Cape, Leipoldt s.n. (B, holo., probably destroyed in 1943). If this specimen was the same as Leipoldt 493 from Clanwilliam (GRA), and from the description it seems to be, it is a synonym of *C. undulatum* (Jacq.) Oberm.

*C. dregei* Poelln. in Port. Acta Biol. 1: 228 (1945). Type: Cape, Drège 1827 (B, holo., probably destroyed in 1943). It may be found in other herbaria. As the specimen had no roots it cannot be determined with certainty whether it was *C. triflorum* or *C. undulatum*.

*C. schlechterianum* Poelln. in Ber. Deutsche Bot. Ges. 61: 208 (1943). Type: Cape, Schlechter s.n. ex hortus Berlin-Dahlem (pressed for herb. 1900; B, holo., probably destroyed in 1943). The roots unknown. It could be *C. undulatum* or *C. namaquense*.

## SPECIES ERRONEOUSLY REFERRED TO SOUTH AFRICA

*C. blepharophyllum* Schweinf. ex Bak. in J. Linn. Soc. 15: 327 (1876). The type comes from Central Africa, Gallabat. Baker in the above publication mentions: "Africa australis, in ditone Transvaal, Baines; perianthium non vidi". Mr. W. Marais looked up the Baines specimen at Kew and found it had three labels: 1. S.A. Goldfields. 2. Segetse, Quae Quae River. 3. Matabele Land, source of the Gwailo River, therefore all from Southern Rhodesia. It has not been recorded from the Transvaal.

*C. inornatum* sensu Bak. in Fl. Cap. 6: 399 as to Bolus 6585 (1897); non Gawler. Baker places Bolus 6585 from Namaqualand under this tropical species. It is *C. namaquense* Poelln.

## 3. TRACHYANDRA

Kunth, Enum. 4: 573 (1843). *Dilanthes* Salisb. Fragm. 70 (1866). *Liriothamnus* Schlechter in Notizbl. Bot. Gart. & Mus. Berlin 9: 145 (1924).

*Perennials*, suffrutescent or herbaceous and in this case the parts above ground dying down in winter; with glandular pubescence in some species. *Roots* various; fibrous or spindleshaped, sometimes swollen only near the tips; in some fused to form a "toed", contracted tuber. *Stems* upright, woody, naked or covered with old leaf bases, or more usually developed as a rhizome. *Rhizome* vertical, seldom horizontal. *Leaves* uniform or dimorphous; base tubular, often persistent as a sheath of fibres. In dimorphous-leaved species, tubular, membranous, basal squamae are present, surrounding the leaves and scape and sometimes the shoots; leaves arranged in a rosette, rarely somewhat distichous, or in congested spirals on aerial stems; lamina flat, triquetrous, terete or canaliculate, hairy or glabrous or glandular-pubescent; sometimes spirally contorted, undulate or plicately folded. *Inflorescence* an axillary, single or branched raceme rarely sub-umbellate; scape terete, naked or with some sterile bracts (vestiges of side-branches); bracts one per flower; pedicels single, not articulated, changing their position during anthesis and when the capsule ripens, erect, patent or recurved, sometimes making a complete loop. *Flowers* single, scentless or with a strong scent, usually opening in the afternoon, closing in the evening. *Perianth* rotate or recurved, erect or pendulous; usually white, rarely yellow, pink or mauve, dark keeled; 3 outer segments slightly narrower than 3 inner; often with yellow, green or dark didymous maculae near the base, caducous, the flower falling off completely if not fertilised; if fruit is formed, the perianth base persists below the ovary forming a small, sometimes stipitate rim or cup. *Stamens* 6, adnate to the very base of the perianth, slightly shorter than the segments, spreading or the inner connivent; filaments similar or dimorphous, retrorsely scabrid, occasionally declinate; anthers versatile, introrse. *Ovary* sessile, globose with 2-16 bi-seriate ovules in each chamber; with septal glands; style filiform, ultimately exserted, often declinate; stigma small, minutely paniculate. *Capsule* loculicidally 3-valved, globose or trisulcate, coriaceous, seldom fleshy; apex obtuse or apiculate, stipitate through abortion of lower ovules; smooth or tuberculate with a few or many, small or large gland-tipped tubercles, rarely with 3 lateral horns. *Seeds* angled, usually brown or grey, smooth or verrucose, with or without prominent ridges; with immersed yellow glands when immature, becoming glutinous when ripe, probably as a result of the glands erupting.

**DISTRIBUTION:** A predominantly South African genus with the majority of the species in the south western Cape; found all over South Africa and South West Africa, a few extending to Southern Rhodesia, Angola, Nyasaland, Kenya and Abyssinia.

Suggested type species; *T. hispida* (L.) Kunth.

Species of *Trachyandra* are found throughout southern Africa, but the majority are endemic to the winter rainfall region of the south western Cape. A few species extend further northwards, one as far as Abyssinia. Linnaeus and others after him classed this group of plants with *Anthericum* but Kunth recognized it as constituting a separate genus which he named *Trachyandra*, giving a good description of it in Enum. 4: 573 (1843). Baker in the Journ. Linn. Soc. 15: 307 (1876) reverted to the old classification and sank the genus as a section under *Anthericum* where it remained until now. On close examination, however, it will be seen that the species belonging to this section are very different from true *Anthericum* and more closely related to *Bulbine*. The axillary inflorescence, the single, non-articulated pedicel and the deciduous perianth are but a few obvious characters that distinguish them from *Anthericum* at a first glance. As in *Bulbine*, the perianth, if the flower is not fertilized, drops off completely; if seed is set, however, its base remains and forms a cup or rim below the capsule. Both have axillary inflorescences, pedicels that change their position when the capsule is formed and leaf-bases that are tubular. Furthermore a parallel development is found in the formation of tuberous roots and the production of aerial stems in some of the species. The caulescent habit of *T. involucreta* induced Schlechter to put it in a separate genus, *Liriothamnus*, with the remark that it showed affinity to *Bulbine caulescens*. But separation solely on its caulescent habit, is not sufficient.

When Kunth published the name *Trachyandra*, referring to its scabrid stamens, he treated the name as feminine as can be seen from his epithets.

#### RESUMÉ OF THE SECTIONS

The genus can be divided into three sections. The first, § *Liriothamnus*, could be regarded as the most primitive. The roots are fibrous and the outer leaves are similar to the later ones. The inflorescence is simple in the majority of species, the perianth (with very few exceptions) immaculate and rotate and the filaments are uniformly scabrid and spreading. The number of ovules varies from 10–2 per loculus. There is a tendency to reduce the number of ovules.

The second section, § *Trachyandra*, shows a much greater diversity in the root system, in the special rudimentary outer leaves or squamae and in the more elaborate floral structure. Amongst its species are so called "tumble weeds". The flowers are often strongly scented, sweet or musklike. The pendulous flower has an ingenious use for its retrorsely scabrid filaments. These form a tube around the ovary, and the nectar, copiously exuded from the septal glands, is collected between the retrorse excrescences of the filaments and attracts insects.

The third section, § *Glandulifera*, is distinguished from the other two sections in the development of glandular hairs. In some varieties of *T. asperata* these may be restricted to a few microscopic stipitate glands on the ovary which afterwards crown the tubercles that emerge with the development of the capsule. In *T. gerrardii* and *T. sabulosa*, however, the whole raceme may be densely glandular while the furry capsule somewhat resembles the fruit of a plane tree, being densely covered with pectinate gland-tipped tubercles. The degree of pubescence and glandulosity is very variable. The inflorescence is always branched (sometimes reduced to a simple raceme, i.e. in some specimens of *T. asperata* var. *stenophylla*), the perianth maculate and the lower ovules absent or abortive giving the capsule a stipitate appearance. This may not be obvious at first in capsules which are densely covered with tubercles, the stipe being hidden by them. The leaves are usually triquetrous. Archibald and Phillips noted that the plants exuded a strong unpleasant odour.

#### MORPHOLOGY:

**Root system:** The roots of the § *Liriothamnus* are fibrous, and numerous. In the § *Trachyandra* they have become storage organs and vary a good deal. In the tumble-weed groups there are many arranged in a congested circle; they are often swollen, elongate-pindle-shaped but not contracted or fused. The thickness depends on the season and whether growth and flower-production have used up much of their contents. The next step, as seen in *T. jacquiniana* and related species, seems to have been the contraction into tubers and a reduction in their number. This development is confined to species of the winter rainfall region. Ultimately the roots and rootstock become fused forming a solid "toed" foot as in some *Bulbines*. How the new parts develop is not yet properly understood. The many hard outer skins suggest that new roots are formed inside the old skins which may remain in situ for a long time. In the § *Glandulifera* they are long, spreading, often branched and the lower half of the root near the tip is swollen. In many species from sandy areas the root is covered by a dense felt composed of long interlacing root-hairs. These are apparently permanent and seem able to absorb water very quickly.

**Stem-rhizome:** One of the most striking features of this genus is the development of a woody stem which may reach a height of up to 6 ft. in *T. adamsoni*. A close ally, *T. involucrata*, also produces a woody, rather gnarled, naked stem while *T. acocksii* and *T. burkei* have short ones that are covered with persistent leaf-bases. In the § *Glandulifera* the Cape species *T. scabra* and *T. sabulosa* also possess short branched stems. The anatomy of the wood was studied by Adamson [J. Bot. Lond. 69: 10 (1931)] who found it to be of typical monocotyledonous development as in *Dracaena*.



The cambium is external and complete amphivasal vascular strands are added, forming separated, secondary ground tissues. Most species however, have a hard, irregularly shaped, woody rootstock. Growth usually takes place in a vertical direction, but in certain species, e.g. *T. brachypoda* and *T. chlamydophylla* the rhizome grows horizontally.

**Leaves:** The bases of all leaves are tubular. A remarkable development has taken place in those species here put in the second section, § *Trachyandra*, where the leaves have become dimorphous, the first or outer leaves having been changed into short tubular membranous prophylls functioning as a protective covering for the vital inner parts. I decided to use the term "squamae" for these organs as "basal rudimentary leaves" is so cumbersome and "prophylls" vague. Jackson's definition of squama, "usually the homologue of a leaf", fits these organs very well. If the monocotyledonous leaf is interpreted as a leaf-base and petiole, we may regard the squamae as the sheathing leaf-bases which have lost their petioles. Their reduction from leaf to squama can be followed in various species. *T. tabularis*, which may be regarded as a link, shows outer leaves that occasionally lose their lamina, thus becoming short tubular prophylls, something often seen in the *Liliaceae*. In the next phase the lamina has disappeared permanently and the squamae now become very different from the leaves. They are now truly dimorphous, brown or white and membranous. One to three narrow tubular squamae can be seen surrounding each leaf- and each scape-base. A further change now takes place in that each shoot becomes surrounded with squamae in addition to those fitted around the leaf- and scape-bases. With the expansion of the shoot these outer squamae often burst and become tattered. In some other species the squamae are wide and loose-fitting, and remain whole. In some, e.g. *T. bulbinifolia* and *T. dissecta* the thin, inner squamae differ from the more sturdy outer squamae.

The leaves sometimes show a slight twist or are strongly wavy or plicately folded or form a stiff spiral. This spiral twisting, waving and folding, is met with in other Monocotyledons from Namaqualand, e.g. in *Ornithogalum*, *Moraea*, *Dipcadi*, *Albuca*, *Babiana*, etc. It could be an adaption to the dry conditions. Certain specimens of one species however show it markedly whereas others growing near it have straight leaves. Pubescence varies from short raised points to long hairs even in one species.

Arber in her classic work on the Monocotyledons remarks on p. 130 that in this phylum there is a greater variety in the width of the leaves amongst the different species than in the Dicotyledons, which could be expected if the "blade" is interpreted as an expansion of the petiolar region. This variation in leaf-width is very marked even in individuals of one species.

Of cytological interest are the spiral thickenings of the vessels in the lamina. They draw out into fine spiral threads when the leaf is broken (cf. Duthie l.c.). It was also observed in *T. laxa* var. *erratica*.

**Inflorescence:** A number of species, all from the first section, have simple racemes i.e. *T. saltii*, *T. esterhuysenae*, *T. reflexipilosa*, etc., but in the majority of species, including the whole § *Glandulifera*, the inflorescence is branched. In some of the branched species, we meet specimens which occasionally bear simple racemes probably because the plants were immature or depauperate. On the other hand there is a definite tendency in some species to suppress side branches. In some species like *T. falcata* and *T. ciliata*, side-branches, although small and suppressed, can always be detected near the base of the raceme. In *T. longepedunculata* these side branches have often disappeared altogether, only the empty bracts remaining. In the above species and some others however, the raceme may elongate to 2 or 3 times its original length during anthesis, becoming prostrate in the process.

In the "tumble-weeds" the raceme is much branched and divaricate. At first the branches, branchlets and pedicels are erect but after flowering they spread out and downwards forming a "ball" which after detachment rolls around in the wind. It is extremely light, the scape consisting mainly of pith. An interesting development



are the accessory branches. It is found in the majority of the species but often one or both side-branches are suppressed. We meet it for instance in *T. laxa* var. *erratica*, where the 3 lowest branches are trichotomous arising from the clavate apex of the scape; the upper branches are alternate. In other species, e.g. in *T. jacquiniana* these accessory branches are found in nearly every axil but one of the branches remains small. If the branch is completely suppressed we still find its bract. In the § *Glandulifera*, *T. asperata*, and *T. gerrardii* also have accessory branches.

**Bracts:** These do not vary very much. Some become nearly amplexicaul, e.g. in *T. falcata*. They show a resemblance to the leaves. From a phylogenetic point of view they are of interest in that they are the last surviving organs in cases where floral side-branches are suppressed. The rhachis, pedicels and flowers may have disappeared but the bracts remain as a relic. This also occurs in *Anthericum* and *Chlorophytum*.

**Pedicels:** They are not articulated. In some cases it would appear as if there could be an articulation near the apex. This occurs in some species, e.g. in *T. tabularis*, after fertilisation when the perianth-base elongates into a short stipe below the persistent rim. If the flower is not fertilized, it drops off completely at the apex of the pedicel. In this case the pedicel remains thin and does not change its position. If a capsule is formed, however, the pedicels move into certain positions, upwards or downwards, patent or with the apex recurved, sometimes forming a complete loop. The ultimate position is constant and makes a useful character for recognizing the species or varieties.

**Flowers:** When the perianth closes after flowering, it fits snugly around the ovary, the apical part protruding above it as a rod. It does not twist. Through pressure of the enlarging ovary, it tears off below and falls off like a pointed cap, leaving its saucers shaped base below the capsule. The perianth is either rotate or revolute. The first species Linnaeus described from the Cape was named *Anthericum revolutum* by him because of its recurved perianth. It forms a graceful "ball" around its pedicel. It is pendulous. A number of related species in this section have the same type of recurved, pendulous perianth but in the majority of the species it is rotate and the flowers face upwards. They are usually white, but in *T. arvensis* they are yellow, in *T. thyrsoides* mauve, and in *T. tortilis* and *T. hirsutiflora* they are pink, while in many a faint pink tinge may be seen. In those species where the segments curve backwards, we find a pair of yellow, green or dark spots near their base, probably serving as honey guides. Duthie, Adamson, Marloth, Jacquin and others noted a strong smell, sweet in some species, musk-like in others. The flowers usually open in the afternoon and close during the night. In the branched racemes a few flowers open daily but on the simple racemes, e.g., in *T. saltii*, they flower profusely from the base upwards after good rains. Within a few days the flowering period is over and the unobtrusive plants sink back into obscurity. The plants however, have young inflorescences near the base, ready to emerge when conditions become favourable once more. In *T. ciliata* and some others the raceme continues to lengthen if conditions remain favourable.

**Stamens:** In the rotate perianths the filaments are uniform, shortly scabrid and spreading. At the base, where they surround the ovary in bud, the filaments are always smooth. In the revolute perianths however, the filaments are dimorphous. The outer spread and are shortly scabrid but the inner are connivent around the ovary; they are flattened and smooth in the lower half where they surround the ovary but have lateral and dorsal fringes. Above the ovary they bend outwards and there have long, retrorse excrescences. As the flowers hang upside down the copious nectar is caught amongst these outgrowths. Miss Duthie records that bees are the chief pollinating insects. The anthers are small and versatile.

**Ovary and capsule:** The number of ovules per cell is fairly constant for each species, occasionally 2 more or 2 less. In the § *Trachyandra* the number of ovules is usually about 10 but in one plant of *T. jacquiniana* 16 ovules were counted in a cell, the largest

number for the genus. However, there is a tendency, especially in the § *Glandulifera*, to reduce the number of ovules or to abort the lowest. The capsule then becomes obovoid or shows a stipe at the base above the persistent perianth rim. The widespread species *T. saltii* has about 8 ovules per loculus, only the upper usually being fertile. In the variety *secunda* with reflexed pedicels only 4 were counted in some of the specimens examined. In the related Angolan species, *T. pyrenicarpa*, each loculus produced only one seed, a large one for the genus. The ovules are axial and biseriate. The placenta is sometimes swollen, perhaps the result of insect irritation. The septal glands produce much nectar. A curious feature of *T. margaretae* is the presence of a dense covering of simple, erect hairs on the young ovary. In *T. zebrina* the ovary is glabrous when young but some reflexed setae appear later on the capsule. The § *Glandulifera* (apart from the two non-glandular species just mentioned) is the only section which has the ovary not glabrous; here it is sparsely to densely covered with stipitate glands. When the capsule matures, simple or complex pectinate tubercles or horns are formed on which the glandular hairs are mounted. The glands erupt and disappear but the excrescences persist in covering the capsules, partly or entirely. The capsules open loculicidally, the walls sometimes recurving. The style is always glabrous. [Baker in the *Flora Capensis* 6, 379 (1897) erroneously mentions in the key "filaments and style scabrous"]. At first the style is short but it eventually becomes longer than the stamens. The stigma is small, penicillate.

**Seed:** When immature, the testa in most species shows golden flecks which appear to be glands which burst when the seed is ripe and thus give it a glutinous coat. The seed is angled, usually grey, smooth or verrucose in certain species. The seeds of the *Glandulifera* species have a different but definite verrucose pattern for nearly each species; it may be globose or flattened or in some with a crenulate wing and with large and small tubercles near the perimeter, the thick central area being fairly smooth.

The species have mostly adapted themselves to very definite, special habitats. The tumbleweeds for instance are always found growing in sandy soils. Others are grassveld species, i.e. the widespread, *T. saltii*, while others, e.g., *T. erythrorrhiza*, prefer marshy surroundings. Adamson in the *Flora of the Cape Peninsula*, records a number of species that flower after veld-fires e.g. *T. muricata*, *T. hirsuta*, *T. hirsutiflora*, etc. Apparently growth is stimulated but this problem has not yet been fully investigated. It occurs in many other genera. The bare ground will become warmer after the vegetative covering has been removed and this may also be a reason for more rapid flowering. Because of their capacity to develop so rapidly they will have completed their annual life cycle by the time their neighbours crowd around them once more.

The plants have no economic importance. Karsten (The old Company's Garden at the Cape, 1951) mentions that shoots of a wild *Anthericum* were served as asparagus on Van Riebeeck's table. It could have been *T. divaricata* which is plentiful around the Cape, producing the fattest and most succulent shoots, or perhaps *T. falcata*, but our recent records of this species show its southernmost habitat to be Saldanha Bay. The plants, especially the tumbleweeds, are eaten by animals, records showing that pigs even dig up the roots. They are not poisonous, although they were often suspected.

In this review 45 species are enumerated from the Union and South West Africa; 10 of these are new species. A few extend beyond our borders, i.e. *T. saltii* which is found in Southern Rhodesia to Kenya and Abyssinia. *T. arvensis* occurs in Northern Rhodesia. *T. reflexipilosa* has also been discovered in Southern Rhodesia. In Angola occurs *T. pyrenicarpa*, a species closely related to *T. saltii* but with one large seed per locule. There is one glandular species, *T. malosana*, recorded from Nyasaland and Southern Rhodesia. It is close to *T. asperata* and may be conspecific. Baker in the *Flora of Trop. Africa* 7: 491 (1898) refers specimens collected in Angola and Beira to "*Anthericum elongatum* Willd." It may prove to be a mixture of species, some perhaps belonging to the tumbleweed group and others probably to *T. saltii*. Von Poellnitz

described a large number of *Anthericum* species from tropical Africa in various publications. Many of his type-specimens were destroyed during the second World War. Some of these may prove to belong to *Trachyandra*.

### KEY TO SECTIONS

Plants not glandular-pubescent:

Plants with the outer leaves occasionally smaller but not changed into squamæ; roots fibrous; inflorescence simple, seldom branched; perianth immaculate, seldom maculate; filaments shortly scabrid..... § 1. *Liriothamnus*

Plants with the outer leaves changed into squamæ; roots usually in a circle, often swollen, sometimes contracted or fused into a few tubers and also fused to the rhizome; inflorescence branched, seldom simple through reduction; perianth usually maculate; filaments uniform or dimorphous, the outer spreading the inner connivent around the ovary and then curving outwards, there with long retrorse bristles..... § 2. *Trachyandra*

Plants glandular-pubescent with the stipitate glands few, minute, confined to the ovary and afterwards the capsule, to densely scabrid-glandular on all parts of the raceme..... § 3. *Glandulifera*

### KEY TO SPECIES

Section 1. LIRIOTHAMNUS. [*Liriothamnus* Schlechter in Not. Bot. Gart. & Mus. Berlin 9: 145 (1924)].

*Roots* wiry, thin, seldom lanate. Aerial *stems* sometimes developed or usually with a *rhizome* which is often covered with fibrous leaf-base remains. *Leaves* uniform (in *T. brachypoda* and *T. tabularis* lamina of primary leaves often reduced). *Inflorescence* simple or branched; scape often arcuate near the base. *Perianth* erect, rotate, immaculate (maculate in *T. adamsonii* and *T. burkei*); filaments spreading, uniform, shortly scabrid; ovules 10–2 per cell, the lower sometimes abortive. *Capsule* glabrous, often stipitate. *Seeds* smooth or verrucose.

**DISTRIBUTION:** Widely distributed.

Plants producing naked, aerial, woody stems: (two species, found in the Vanrhynsdorp and Namaqualand districts: *Liriothamnus* Schlechter):

Shrubs with bare stems up to 6 ft. high; leaves flat, over 2 cm wide, perianth maculate; capsule erect..... 1. *T. adamsonii*

Shrubs usually about 2 ft. high; leaves terete ca. 6 mm in diam.; perianth not maculate; capsule recurved..... 2. *T. involucreta*

Plants producing short aerial stems, which are covered with leaf-bases:

Leaf-bases hard, thick, quill-like; leaves many; inflorescence simple, perianth immaculate 3. *T. acocksii*

Leaf-bases long with reticulated thickenings; leaves few; inflorescence usually branched; perianth maculate..... 4. *T. burkei*

Plants without aerial stems; with rhizomes; raceme simple or branched; nerves of leaf-bases often persistent as fibres:

Inflorescence simple:

Ovary glabrous:

Leaves usually less than 5 mm wide, variously pubescent but not with long reflexed setae only:

Leaves flat or terete, glabrous or with soft long hairs and short curly ones; scape sharply arcuate below pushing inflorescence outside leaf rosette; 4–8 ovules per loculus (Summer rainfall region)..... 5. *T. saltii*

Leaves filiform, glabrous; flowers congested near the apex; pedicels short; 2 ovules per loculus (Great Winterhoek Mountains, Cape)..... 6. *T. esterhuysenae*

Leaves filiform with a uniform, white, short curly pubescence; inflorescence lax; pedicels ca. 15 mm long; 6 ovules per loculus (Calvinia)..... 7. *T. gracilentia*

Leaves usually 8 mm wide, flat; upper surface glabrous, lower surface and scape evenly setose with long, straight, retrorse hairs; immature scape densely reflexi-pilose; pedicels untidy, straggling in all directions, patent or erect in fruit, 15–25 mm long, thin; raceme long, lax, flowers in irregular groups along rhachis..... 8. *T. reflexipilosa*

Ovary densely pubescent with tawny, erect hairs..... 9. *T. margaritae*



Inflorescence branched:

Plants rosulate:

Mouth of leaf-base fimbriate (eastern Cape)..... 10. *T. affinis*

Mouth of leaf-base not fimbriate (Cape Peninsula):

Sclerotic plants; leaf margin raised, smooth; flowers laxly arranged on rhachis; perianth segments ca. 8 mm long; capsule globose, dry; seeds smooth, usually 1 per loculus..... 11. *T. brachypoda*

Soft plants; leaf margin not raised, minutely denticulate; flowers fairly close together; perianth segments ca. 12 mm long; capsule trisulcate, slightly fleshy; seeds with 3 prominent, crenulate ridges, tubercular, usually several per loculus 12. *T. tabularis*

Plants sub-stichous, softly hairy; leaves soft, erect; seeds with small ridges, somewhat tuberculate..... 13. *T. hirsuta*

## Section 2. TRACHYANDRA. [*Dilanthes* Salisb. Fragm. 70 (1866)].

*Roots* many, swollen, arranged in a congested circle, fusiform or contracted, sometimes fused together and with the rhizome. *Outer leaves* changed to squamæ. *Inflorescence* branched, often with accessory branches at the nodes, seldom simple through reduction. *Perianth* erect or pendulous, rotate or recurved, maculate (except in *T. chlamydophylla*, *T. hispida*, *T. peculiaris* and *T. hirsutiflora* where it is immaculate); filaments subequal, shortly scabrid or dimorphous with the three outer spreading, shortly scabrid, the three inner connivent around the ovary, with dorsal and lateral fringes, curving outwards above and there with long retrorse bristles; ovules 16-4 per cell. *Capsule* glabrous (except in *T. zebrina* and *T. hirsutiflora*) never stipitate. *Seeds* smooth or verrucose.

**DISTRIBUTION:** Found mainly in the south western Cape; a few species belonging to the tumbleweed group found northwards as far as Southern and Northern Rhodesia and Angola.

Inflorescence a simple raceme or rarely with a few short basal, ascending branches, elongating during anthesis; scape often with a few sterile bracts (vestiges of undeveloped side branches); plants glabrous or hairy; perianth immaculate (maculate in *T. falcata* and *T. ciliata*):

Each leaf-base wrapped up in separate tubular, brown, firm squamæ but no squamæ surrounding shoots; inflorescence simple; rhizome horizontal; roots all alike, hard, cylindrically swollen, not bulbous; perianth immaculate, glabrous..... 14. *T. chlamydophylla*

Each shoot as well as the leaf-bases and scapes wrapped up in tubular, membranous, loose squamæ, the outer bursting when plants expand; inflorescence simple or with a few short, basal branches (*T. falcata*); pedicel usually recurved in fruit (except in *T. hirsutiflora*); rhizome vertical; roots often bulbous; perianth immaculate or maculate, hispid on the outside (glabrous in *T. longepedunculata*):

Inflorescence simple, scape naked:

Racemes capitate, dense, short, the lower pedicels long, overtopping the apex of the inflorescence; pedicels recurved in fruit; leaves usually longer than the raceme:

Bracts long, linear-acuminate, ending in a soft awn, hispid; (Cape Peninsula) 15. *T. hispida*

Bracts deltoid, glabrous, white, membranous, edges fimbriate (South West Africa) 16. *T. peculiaris*

Racemes spicate, white- or fawn-tomentose; pedicels erect in fruit..... 17. *T. hirsutiflora*

Inflorescence with a few, short side-branches or rarely simple through reduction, if simple then with 1-3 sterile bracts below inflorescence (vestiges of side branches), when old often prostrate:

Leaves flat, ca. 2.5 cm wide; perianth softly hairy on outside, sometimes glabrous or becoming glabrous: young inflorescences with bracts closely imbricate, resembling an ear of corn; large plants:

Lower bracts not amplexicaul; inflorescences ultimately prostrate; pedicels recurved in fruit..... 18. *T. ciliata*

Lower bracts amplexicaul; inflorescence erect; pedicels erect in fruit..... 19. *T. falcata*

Leaves terete, 2 mm in diam. scapes bracteate, often mottled at the base; perianth glabrous outside; slender, glabrous plants..... 20. *T. longepedunculata*

Inflorescence a divaricate raceme, seldom simple in immature or starved plants; scape naked, erect; perianth maculate:

Squamæ surrounding shoots absent. Leaves and scapes arranged horizontally on the discoid rhizome; each leaf- and scape-base separately surrounded by several close-fitting tubular



squamae; roots many, firm, often spindle-shaped but not fused or contracted into tubers, the new ring of spreading roots formed above the old one; perianth recurved; filaments dimorphic, 3 inner with long, retrorse bristles in upper half; tumbleweeds:

Flowers white, pedicels up to 1 cm long:

Stout, glabrous, littoral plants; panicle branches usually short, dichotomous or trichotomous, patent, many-flowered; capsule often somewhat fleshy, ca. 1 cm in diam., perianth recurved from the middle..... 21. *T. divaricata*

Smaller plants, glabrous or with the base of scape hairy and leaves rough; not littoral; racemes laxly flowered; capsule small, dry; perianth recurved from near the base:

Scape-base minutely, sparsely hairy, seldom glabrous; leaves rough, flat or rolled; lowest branches not trichotomous; perianth segments ca. 8 mm long; filaments yellow at the base (southern and south eastern Cape)..... 22. *T. revoluta*

Scape-base glabrous; leaves terete, smooth, sometimes glutinous; branches of raceme alternate or the 3 lowest trichotomous with the apex of the scape clavate; perianth segments ca. 12 mm long; filaments yellow in the middle (Kalahari sandveld) 23. *T. laxa*

Flowers yellow, plants slender, laxly flowered; pedicels up to 15 mm long,.... 24. *T. arvensis*

Squamae surrounding shoots present, bursting when plants develop (often worn away in older specimens); leaves and scapes arranged vertically on the narrow rhizome; leaf- and scape-bases surrounded by thin, smaller inner squamae, which are usually different to the outer ones; roots various; perianth spreading or recurved; filaments uniform or slightly dimorphic:

Roots many, not fused or contracted:

Leaves 2 or few, opposite, flat, up to 5 cm wide, smooth or usually muricate; roots many, usually fairly thin and long..... 25. *T. muricata*

Leaves many (if few, roots spindleshaped), linear, hairy or glabrous; squamae numerous, white, entire or inner fimbriate:

Roots somewhat spindleshaped; inner squamae often fimbriate; leaves minutely setaceous or glabrous; filaments minutely papillate..... 26. *T. bulbifolia*

Roots not spindleshaped, usually long, felted:

Plants lanate; inflorescence umbellate (Namib)..... 27. *T. lanata*

Plants with retrorse, coarse hairs; inflorescence not umbellate, compact; flowers mauve or pinkish (Karoo)..... 28. *T. thyrsoides*

Roots few, contracted, bulbous, often fused into one or a few hard tubers or tuber split at the base into several points:

Pedicel recurved in fruit; small plants; leaves few, flat, glabrous, linear-lanceolate, usually transversely plicate..... 29. *T. tortilis*

Pedicels patent or erect in fruit:

Ovules 12-16 per cell; ovary oblong; leaves linear, up to 5 mm wide, glabrous or with reflexed, long, silky hairs, wavy when young; large plants up to 40 cm high; panicles divaricate with accessory branches in nearly all axils; pedicels short ascending; capsule ultimately touching rhachis; roots usually fused, often hard... 30. *T. jacquiniana*

Ovules 6-11 per cell; ovary ovoid; leaves filiform or (in *T. paniculata*) linear-lanceolate, variously hairy or glabrous; plants usually up to 30 cm high; panicles with or without accessory branches:

Leaves few, flat, linear-lanceolate, ca. 1 cm broad, glabrous above, shortly pubescent below; panicle with accessory branches; roots soft, bulbous, not fused 31. *T. paniculata*

Leaves several, filiform or linear, less than 1 cm broad, glabrous or variously pubescent:

Capsule, pedicel and rhachis shortly setose with sparse, reflexed bristles; squamae forming a long neck, often transversely striped with dark bands.... 32. *T. zebrina*

Capsule, pedicel and rhachis glabrous:

Pedicels 1-3 cm long, patent:

Inflorescence about as long as the leaves, pedicels up to 3 cm long, side-branches of inflorescence about as long as main branch; roots fused into a hard tuber split below..... 33. *T. karrooica*

Inflorescence overtopping the leaves, divaricately branched with many accessory branches; pedicels 10-15 mm long; squamae usually forming a long, sleek, brown neck; root-tubers not fused..... 34. *T. patens*

Pedicels short, less than 1 cm, erect, capsule ultimately touching rhachis:

Leaves 3-15, soft, more or less flat above, convex below, glabrous or with a few to many, retrorse bristles along margin; bracts aristate; raceme simple or few-branched; small plants..... 35. *T. oligotricha*

Leaves 2-6, usually wavy, wiry, light green, ribbed, muricate or glabrous; scape shortly hairy or glabrous; bracts aristate; plants variable in size 36. *T. flexifolia*

Leaves ca. 3, filiform, straight; plants glabrous, racemes divaricate, laxly flowered; bracts minute, mucronate; outer squamae hard, brown, forming a neck, inner thin, breaking up into shreds..... 37. *T. dissecta*

## Section 3. GLANDULIFERA.

*Roots* wiry or stout and woody, often with some fusiform swellings near the tips. *Rhizome* woody, sometimes produced into short branches. *Leaves* uniform, triquetrous or flat and keeled, glabrous or hairy, bases often persisting as fibres. *Inflorescences* branched, often with accessory branches, rarely simple through reduction. *Perianth* erect, rotate, maculate; filaments spreading, uniform, shortly scabrid; ovules 6-2 per cell, the lower sometimes abortive. *Capsule* covered with a few to many gland-tipped tubercles, usually obovoid or with a short stipe. *Seeds* verrucose. *Glands* few to many, either confined to a few on the ovary, which become stipitate when the capsule develops, or the whole raceme glandular; in some species the raceme is scabrid with truncate, gland-tipped tubercles; the glands disappear with age.

**DISTRIBUTION:** Two species are endemic in or near the Cape Peninsula in sandy habitats, a third is found only in South West Africa, the majority occur in the eastern Cape, northwards to the eastern Transvaal, on mountain grasslands or in marshy places, extending as far as Nyasaland.

Leaves in a terminal fascicle at the end of very short, woody branches; ovules 2 per cell:

Pedicels patent, recurved at the apex in fruit (South Western Cape):

- Capsule ob-triangular, contracted at the base, with a few gland-tipped tubercles and some transverse ridges..... 38. *T. scabra*  
 Capsule globose (stipe hidden) densely covered with dendroid, gland-tipped tubercles 39. *T. sabulosa*  
 Pedicels erecto-patent in fruit; plants densely glandular, glands shortly stipitate (South West Africa)..... 40. *T. glandulosa*

Leaves rosulate or somewhat distichous from a basal rhizome; pedicels erect or twisted; ovules 6-2 per cell (eastern Cape to eastern Transvaal):

Ovules 6-4 per cell; base of plant fibrous; capsule not horned:

- Capsule ca. 5 mm in diam. when fully developed (unknown in *T. capillata*) with few to many short gland-tipped tubercles and some transverse ridges on the skin:  
 Roots thin fibrous, fusiform near the tip:  
 Leaves filiform to linear, usually 15-20 cm long, tapering to the apex, grasslike 41. *T. asperata*  
 Leaves few, triquetrous, over 40 cm long, each face ca. 8 mm broad, soft, with soft golden hairs..... 42. *T. capillata*  
 Roots red, stout, ca. 4 mm in diam. cylindrical; leaves flat, somewhat distichous; pedicels erect..... 43. *T. erythrorrhiza*  
 Capsule ca. 10 mm in diam. when fully developed, burry, being covered with pectinate, gland-tipped tubercles; robust plants with hairy leaves and scabrid-glandular, branched racemes..... 44. *T. gerrardii*  
 Ovules 2 per cell; base of plant not fibrous; capsule with 3 lateral horns..... 45. *T. giffenii*

## Section 1. LIRIOTHAMNUS (Schltr.) Oberm., stat. nov.

*Liriothamnus* Schltr. in Not. Bot. Gart & Mus., Berlin 9: 145 (1924).

1. *T. adamsonii* (Compton) Oberm., comb. nov.

*Liriothamnus adamsonii* Compton in J. Bot. Lond. 69: 10 (1931). Type: south western Cape, Vanrhynsdorp, mouth of the Doorn River near Klaver, Compton (NBG. 318/22, holo.!).

Shrubs with a vertical, woody stem, up to 180 cm high, branched near the apex. *Roots* about 5 mm in diam. lanate. *Stems* ca. 2 cm in diam. covered with hard leaf-bases which may eventually disappear. *Leaves* in tufts near the apex, somewhat fleshy glaucous, glabrous, 16-30 cm long, 15-35 mm wide, with about 25 nerves, margin minutely denticulate. *Inflorescence* axillary, simple or with 1-2 small basal branches, 30-50 cm long, bracts widely ovate, long acuminate, 10 mm long, 3 mm wide, membranous, margin minutely denticulate; pedicels erect, stout, up to 10 mm long in fruiting stage. *Flower* with perianth white or faintly flushed with pink, maculate and probably recurved; segments up to 14 mm long; filaments scabrid; ovary with ca. 9 ovules per loculus, style terete, stigma minute. *Capsule* erect, ovate, 12 mm long, 5 mm broad, apex obtuse. *Seeds* 3 mm long, tuberculate.

Flowering Period: August.

**DISTRIBUTION:** Only known from the type area.

CAPE.—Clanwilliam: Doorn River Bridge, *Compton* 22779 (NBG); Doornpoort, *Hall* 810 (NBG).

Live plants of this interesting species were collected by Compton in 1922 and cultivated at Kirstenbosch where they flowered in August, 1926. Adamson collected fruiting material at the type locality in September 1923 and examined the secondary thickening of the stem which was like that of *Dracaena*.

2. *T. involucrata* (Bak.) Oberm., comb. nov.

*Anthericum involcratum* Bak. in J. Linn. Soc. 15: 311 (1876). Type: Cape, Namaqualand near Mierenkasteel, *Drège* 2681 (K, hol., L, iso.! PRE, photo.).

*Liriothamnus involucratus* (Bak.) Schltr. in Notizbl. Bot. Gart. & Mus. Berlin 9: 145 (1924).

Small gnarled, woody shrubs up to 60 cm high. *Roots* many, slightly thickened, lanate. *Stems* ca. 1 cm in diam. at the base, 3 mm in diam. near the tips. *Leaves* in tufts near the apex usually on short young branches; leaf-bases forming a membranous, wide, conspicuous tube sometimes produced into a denticulate point opposite the lamina; lamina terete, succulent, ca. 17 cm long, ca. 6 mm in diam. glaucous, glabrous, canaliculate, long acuminate in upper half. *Inflorescence* simple or branched, up to 26 cm long; bracts small, 7 mm long, acuminate, scarious; pedicels up to 2 cm long in fruit, recurved in an S-shaped loop. *Flower* with perianth rotate, immaculate, white, segments 10 mm long, 2 mm broad; filaments spreading, scabrid; ovary globose with about 9 biseriate ovules per cell. *Capsule* pendulous narrowly ovoid, 18 mm long, tapered below and above; opening at the apex where the points then recurve giving it a 3 horned appearance. *Seeds* (immature) verrucose?

Flowering Period: July. A faint scent was noted at times when a plant flowered at the Division of Botany.

DISTRIBUTION: Namaqualand.

CAPE.—Namaqualand: Richtersveld, Twee Rivieren, *Marloth* 12268 (PRE); Kubus Mt., *Dyer* & *Verdoorn* 1841 (PRE); Nigraemoep, *Acocks* 19355 (PRE); Karee Mt., *Schlechter* 8190 (PRE).

3. *T. acocksii* Oberm., sp. nov., distincta, nullis e specibus notis propinqua.

Plantae ad 45 cm altae gregariae, caulibus brevibus lignosis. *Folia* glabra glauca dura, 12–30 cm longa, basi reliquiis penniformibus breves erecti. *Flores* basi cupuliformes; ovula in loculis 4. *Capsula* globosa parva stipitata. *Semina* glabra.

Small glabrous, glaucous shrublets up to 45 cm high, with hard leaves, growing in dense clumps. *Roots* hard, woody. *Stems* short, branched, woody, densely covered with the congested, hard quill-like leaf-bases. *Leaves* 12–30 cm long, triangular in cross-section, hard, glaucous, glabrous, straight or with a lax spiral twist when young. *Inflorescence* a simple raceme up to 50 cm long; bracts minute, subulate, membranous, white; pedicels erect, up to 15 mm long in fruit. *Flower* with perianth forming a short cup at the base, segments white, spreading, keel broad and dark; filaments uniform, spreading; ovary with ca. 4 ovules per cell. *Capsule* globose, dry, 5 mm in diam., contracted at the base. *Seeds* about 2 per cell, smooth, grey.

Flowering Period: January–May, apparently after rains.

DISTRIBUTION: Recorded only from the Great Karroo, where the plants are confined to the eastern slopes growing high up on rugged hills, amongst boulders.

CAPE.—Bristown: Brewershock, *Loots* (PRE, 7609). Beaufort West: *Watt* (PRE, 26454); near Nelspoort, *Acocks* 15877 (PRE). Richmond: 7 miles W. N.W. of Richmond, *Acocks* 16338 (PRE, hol.).

4. *T. burkei* (Bak.) Oberm., comb. nov.

*Anthericum burkei* Bak. in J. Bot. Lond. 1872, 140; in J. Linn. Soc. 15: 298 (1876).



Type: Transvaal, Apies River, *Burke* (K, holo.). The locality is doubtful as the species occurs only in the eastern Kalahari sandveld.

*Bulbinella burkei* (Bak.) Benth. in Gen. Plant. 3: 784 (1883); Bak. in Fl. Cap. 6: 358 (1896).

Hard, grasslike plants forming short, woody stems at the base which are densely covered with reticulate fibres. *Roots* many, covered by a short, felted covering of root hairs. *Stems* short, woody below, the new shoots formed laterally, covered with the tubular, reticulated leaf-bases which afterwards remain as coarse, long fibres. *Leaves* few, the long, reticulated leaf-bases tightly clasped around the young leaves and bases of scapes, venation consisting of parallel sclerenchymatous veins connected by ascending oblique lateral veins; lamina semi-terete, flattened above, up to 40 cm long, 2 mm wide, hard. *Inflorescence* a divaricate raceme with di- and trichotomous branching, ca. 30 cm tall; scape short, arcuate at the base, terete, glabrous; pedicels, patent, up to 15 mm long; bracts minute, subulate. *Flower* with perianth spreading or slightly recurved, segments ca. 6 mm long, maculate with 2 green or dark spots at the base; filaments erect shortly scabrid; ovary with 2 ovules per cell. *Capsule* small, erect, ca. 5 mm, somewhat 3 lobed, constricted at the base. *Seeds* apparently 1 per cell (no ripe seed seen).

Flowering Period: September–March. Flowers sweetly scented (*Acocks*).

DISTRIBUTION: A psammophyte found in the south eastern Kalahari sandveld. Recorded from the Kimberley district, north western Free State, south western Transvaal and Bechuanaland.

CAPE.—Kimberley: near Riverton, *Acocks* 742 (PRE).

ORANGE FREE STATE.—Boshof: Smitskraal, *Burt Davy* (PRE 11312, 11356).

TRANSVAAL.—Christiana: Kameelpan, *Theron* 518 (PRE). Wolmaransstad: Boskuil, *Sutton* 53 (PRE). Lichtenburg: *Kinges* 1890 (PRE). Mafeking: *Brueckner* 451 (PRE), *Leistner* 568 (PRE).

BECHUANALAND.—14 miles N.W. of Molepolole, *Codd* 8943 (PRE).

The reticulate structure of the persistent long leaf-base, resembling some *Bulbinella* species is unique in the genus. This character no doubt induced Bentham to place it in that genus but the structure of the flower and capsule make it a *Trachyandra*.

5. *T. saltii* (Bak.) Oberm., comb. nov., aggregate species.

*Anthericum saltii* Bak. in J. Linn. Soc. 15: 309 (1876); in Fl. Trop. Afr. 7: 492 (1898). Fig. 5.

Grasslike plants 10–50 cm high. *Roots* many, wiry, fairly stout. *Rhizome* vertical. *Leaves* variable in size, filiform to linear, 5–50 cm long, 1–25 mm wide; lamina flat or rolled, tapering to the apex, below gradually dilated into a tubular, membranous base, mouth fimbriate; glabrous or pubescent with long straight hairs sometimes intermixed with short curly hairs; nerves in basal part of leaf sometimes persistent as fibres (if sclerenchymatous because of dry conditions). *Inflorescence* a simple raceme, usually many-flowered; several young racemes usually present near the base of the plant; scape arcuate near the base, protruding outside the leaf-rosette, 6–40 cm long; bracts small, narrow, cuspidate, margin fimbriate or smooth; pedicels 8–15 mm long, ascending, sometimes recurved in fruit. *Flower* with perianth segments ca. 1 cm long, typical; stamens typical; ovary turbinate, with ca. 8 ovules per cell, the lower usually aborting. *Capsule* globose 5 mm in diam. glabrous, constricted at the base. *Seeds* grey, smooth.

Flowering Period: November–March after good rains. A number of flowers open in the afternoon and fade during the night, the inflorescence finishing its flowering period in 2 or 3 days. Young inflorescences are present below and emerge at the next favourable opportunity.





FIG. 5.—*Trachyandra saltii* (Bak.) Oberm. a, habit,  $\times \frac{1}{2}$ . b, tubular leaf base, enlarged. c, gynaecium. d, stamen. e, capsule.

**DISTRIBUTION:** Common on the highveld and eastern grassveld of the Cape, Natal, Orange Free State and Transvaal, Bechuanaland, South West Africa, Southern Rhodesia and extending northwards to Abyssinia. Absent from the karroo and winter-rainfall districts.

This species seems very adaptable; it has been found in dry surroundings growing only a few inches high or near the river banks, 20 inches high. It has been described several times throughout its range but no sound differences could be found between the synonyms cited. Mr. John Lang of the British Museum was kind enough to compare specimens from South Africa with the type of *Anthericum saltii* Bak. and he found them to be conspecific.

Baker and others after him, attached some importance to the absence or presence of basal fibres, referring the fibrous ones to *Anthericum micranthum* Bak. and those without to *A. elongatum* var. *holostachyum* Bak. This sclerenchymatous tissue is developed more profusely under dry conditions, but has no systematic value.

From the ample material seen, I could group the specimens roughly into 3 forms. These were not restricted to geographical areas. The distribution for instance of the var. *secunda* with pedicels recurved in fruit, agrees with that of var. *saltii* in South Africa. The var. *oatesii* with its long, erect, pedicels was found in Southern Rhodesia and in the Kimberley area; side by side, however, the var. *saltii* with short, erect pedicels also appeared.

#### KEY TO VARIETIES

Pedicels erect in fruit:

- |   |                        |
|---|------------------------|
| Pedicels, ca. 1 cm long.....  | a. var. <i>saltii</i>  |
| Pedicels ca. 2-3 cm long.....   | b. var. <i>oatesii</i> |
| Pedicels recurved and often pseudo-secund in fruit, ca. 15 mm long..... | c. var. <i>secunda</i> |

#### (a) var. *saltii*.

*Anthericum saltii* Bak. in J. Linn. Soc. 15: 309 (1876). Type: Abyssinia, Salt (BM, holo.). *A. micranthum* Bak. in J. Bot. 1891, 71; et in Fl. Cap. 6: 388 (1897). Type: Cape, Griqualand West, du Toit's Pan near Kimberley, Elliott 1220 (K, holo., incomplete, according to Miss Kies who examined the type). *A. elongatum* var. *holostachyum* Bak. in Flor. Cap. 6: 389 (1897). Type of var.: Cape, Griqualand East, Tyson 2122 (K, holo.). *A. crassiusculum* Dinter in Fedde, Rep. 29: 266 (1931). Poelln. in Fedde, Rep. 52: 235 (1943). Type: South West Africa, Otavi, Dinter 5275 (B, holo.! PRE, photo.). *A. aristatum* Poelln. in Fedde, Rep. 50: 321 (1941); et in Fedde, Rep. 52: 234 (1943). Type: South West Africa, Grootfontein, Schoenfelder 919 (B, holo.!, PRE, iso.!). *A. brevitepalum* Poelln. in Bol. Soc. Brot. 16, 2: 71 (1942). Type: Transvaal, Komatipoort, Schlechter 11846 (B, holo.!, PRE, photo.). *A. gracilitepalum* Poelln. in Bol. Soc. Brot. 16, 2: 53 (1942). Type: Transvaal, Middelburg, Nazareth, Schlechter 4480 (B, holo.!, PRE, BOL, iso.!). *A. amboense* Poelln. in Fedde, Rep. 52: 233 (1943). Type: South West Africa, Amboland, Umkuanyama, Rautanen 439 (B, holo.? probably destroyed; K, iso.). *A. cepaeefolium* Dinter apud Poelln. in Fedde, Rep. 52: 235 (1943). Type: South West Africa, Windhoek, Avas Mts., Dinter 1885 (B, syn.? probably destroyed, NBG. iso.!) Gaub, Dinter 2458 (NBG, iso.!). *A. lanzae* Cuf. in Miss. Biol. Borana, Racc. Bot. Angiosp. IV, 306, photo, p. 307 (1939), e descr. Type: Eritrea; Arero, Miss. Biol. 321 (RO, syn.); Javello, Miss. Biol. 544 (RO, syn.) *A. kässneri* Poelln. in Fedde, Rep. 50: 322 (1941) e descr. Type: Kenya, Kässner (B, holo.?).

**SOUTH WEST AFRICA.**—Grootfontein: Auros, Volk 801, 8368 (M). Keetmanshoop: Western Karasberg, Pearson 7970 (BOL, distributed under the name *A. pilosum* Bak.). **CAPE.**—Barkley West: Newlands, Ferrar 24 (NH); Warrenton: near Warrenton, Hafström H950 (PRE). Kimberley: Acocks 77 (PRE), Esterhuysen 1159 (BOL).

Griqualand East: near Clydesdale, *Tyson* 2122 (GRA). Middelburg: Bangor farm, *Bolus* 14047 (BOL), *Gill* 109 (PRE).

BASUTOLAND.—LERIBE, *Dieterlen*, 322, 348 (PRE).

ORANGE FREE STATE.—Fauresmith: *Smith* 960 (PRE). Kroonstad: *Pont* 625 (PRE). Vrededorst: *Parys*, *Bruce* 145 (PRE). Bloemfontein: *Lam & Meeuse* 4787 (L.).

NATAL.—Estcourt: *Acocks* 10610 (PRE). Polela: *Killick & Marais* 2089 (PRE).

TRANSVAAL.—Sibasa: Kruger National Park, Baiandbai *Lang* (TM 32150, PRE, NH); near Punda Maria, *Lang* (TM 31107, PRE). Warmbaths: *Sidey* 1159, *Collins* 2409 (PRE). Carolina: *Galpin* 12211 (PRE). Germiston: Modderfontein, *McLean* (PRE). Heidelberg: Suikerbosrand, *Schlechter* 3498 (PRE, BOL). Christiana: *Theron* 437 (PRE).

SOUTHERN RHODESIA.—Urungwe Reserve, Mgunje, *Wild* 4155 (SRGH, PRE); Mt. Selinda, *Hack* 54 (SRGH). Umtali, *Chase* 5938 (SRGH, PRE). Salisbury, *Wild* 3685 (SRGH).

NORTHERN RHODESIA.—Mapanza, Choma, *Robinson* 2948 (SRGH); Medinilunga, *Milne-Redhead* 1078 (PRE).

KENYA.—Ngong Hills, *Greenway* 8475 (PRE); western slopes of Kilimanjaro, *Greenway* 4394 (PRE); Moyale, *Gillett* 13980 (PRE); named *Anthericum lanzae* Cufodontis).

UGANDA.—Ruizi River, *Jarrett* 341 (PRE); named *A. kässneri* Poelln.).

(b) var. *oatesii* (Bak.) Oberm., stat. et comb. nov.

*Anthericum oatesii* Bak. in J. Bot. Lond. 1878; 324; et in Oates, Matab. ed. 2: 411, t.13 (1889). Type: Southern Rhodesia, Matabeleland, *Oates* (BM, holo.). *A. betschuanicum* Poelln. in Bol. Soc. Brot. 16, 2: 53 (1942). Type: Cape, Bechuanaland, Kuruman, *Marloth* 1014 (B, holo., PRE, iso.!).

SOUTHERN RHODESIA.—Umvukwes, Mazoe, *Wild* 3985 (SRGH). Matobo, *West* 2506 (SRGH). Farm Besnakobila, *Miller* 4867 (SRGH, PRE); Embakwe, *Feiertag* (SRGH, 45422). Makoni, Maidstone: *Norlindh & Weimarck* 4132 (SRGH).

CAPE.—Kimberley: Macfarlane, *Acocks* 1410 (PRE, BOL).

ORANGE FREE STATE.—Fauresmith: *Henrici* 4247 (PRE).

(c) var. *secunda* (Krause & Dinter) Oberm., stat. et comb. nov.

*Anthericum secundum* Krause & Dinter in Engl. Bot. Jahrb. 45: 127 (1911). Poelln. in Fedde, Rep. 52: 260 (1943). Type: South West Africa; Grootfontein, *Dinter* 855 (B, holo.? probably destroyed; NBG, iso.!). The description noted that the pedicels were erect after the flowers had dropped off; probably the flowers were not fertilised. The type number in NBG shows recurved, fruiting pedicels. In the original description the length of the pedicel was stated to be 1 dm, but this must have been 1 cm. In some specimens only four ovules were counted in a cell.

TRANSVAAL.—Pretoria: Magaliesberg, Witfontein, *Smith* 12 (PRE); Wonderboom, *Repton* 2762 (PRE). Germiston: Modderfontein, *Conrath* 660, 665 (GZU). Nelspruit: Pretorius Kop, *van der Schijff* (PRE). Pietersburg: *Moss* 15665 (PRE, J.). Pilgrim's Rest: Calais, *Killick & Strey* 2557 (PRE).

ORANGE FREE STATE.—Senekal: Doornkop, *Goossens* 684 (PRE).

CAPE.—Albert: Burghersdorp, *Pocock* 103 (GRA).

NATAL.—Hlabisa: *Ward* 1557 (PRE). Richard's Bay, *Lawn* 1728 (NH).

PORTUGUESE EAST AFRICA.—Delagoa Bay, *Junod* 399 (SRGH); Inyamosan, *Schlechter* 12072 (PRE).

NYASALAND.—Zomba, *Jackson* 2082 (SRGH).

SOUTHERN RHODESIA.—Inyanga, *Chase* 3683 (SRGH); *Fries*, *Norlindh & Weimarck* (SRGH).

6. *T. esterhuysenae* Oberm., sp. nov. *T. saltii* affinis sed plantis glabrescentibus ovulis duobus differt.

*Plantae* graminiformes. *Folia* subteretia glabra, basi reliquiis duris longis fibrosis. *Racemi* simplices ad apicem congesti; scapus bracteis minutis; pedicelli erecti. *Ovula* in loculis 2 pendula. *Capsula* erecta globosa.

Grass-like plants up to 50 cm long. *Roots* unknown. *Rhizome* unknown. *Leaves* semiterete to narrowly linear, up to 50 cm long, 1-2 mm broad, glabrous; leaf-bases persisting as hard, long fibres. *Inflorescence* simple, flowers aggregated near the apex; scape erect, straight, up to 50 cm long, with some empty bracts below raceme; bracts small; pedicels short ca. 5 mm long, ascending to erect. *Flower* with perianth segments ca. 5 mm long; filaments papillate (nearly smooth in one flower); ovary with 2 pendulous, collateral ovules in each loculus. *Capsule* (immature) globose, erect.

Flowering Period: February.

DISTRIBUTION.—Apparently confined to high altitudes on mountains in the south western Cape districts.

CAPE.—Worcester: Slangoek Mts., Observation Peak, shale band, *Esterhuysen* 5613 (BOL, holo.!, PRE, photo.). Caledon: Kogelberg, *Esterhuysen* 9961 (BOL). Stellenbosch: Hottentots Holland Mts., above Diepgat, *Esterhuysen* 16728 (BOL); Banhoek Kloof, *Esterhuysen* 19902 (BOL). Piketberg: Twenty-four Rivers Mts., above Porterville, sandy, swampy flats, *Esterhuysen* 16616 (BOL).

The 2 pendulous collateral ovules show affinity to *Bulbinella*, which it does resemble superficially. In *Bulbinella* however, the perianth is star-shaped and persistent whereas our species has a typical *Trachyandra* perianth, for in fading the segments fuse above the ovary, and it then drops off, where the pressure of the expanding capsule tears it apart. The species resembles *T. tabularis* but this species has a branched inflorescence and 6 ovules per cell to mention but a few differences.

I have named it after Miss E. Esterhuysen who collected it in four different localities. So far there is no record of anybody else having collected it.

7. *T. gracilenta* Oberm., sp. nov. *T. esterhuysenae* Oberm. affinis, sed ita differt: plantae pilis minutis albis crispis indutae, pedicelli longiores, loculi 6 non 2-ovulati.

*Plantae* graminiformes. *Radices* multae lanatae ad acumen tumescentes. *Folia* linearia tomentosa, pilis minutis albis crispis induta. *Racemi* simplices laxi, scapo tomentoso, pedicellis sub anthesi 15 mm longis. *Ovula* in loculis 6.

Grass-like plants up to 40 cm high. *Roots* many, covered with felted root hairs; with some swellings near the tip. *Rhizome* small, woody. *Leaves* linear, rolled, 40 cm long, 1-2 mm broad, ribbed, evenly pubescent with small, white curly hairs, bases persistent but usually not breaking up into fibres. *Inflorescence* a simple, lax raceme, 20-30 flowered: scape slender terete, minutely pubescent; bracts minute, white, subulate, fimbriate, folded around pedicel: pedicels 15 mm in flower, spreading. *Flowers* with perianth probably spreading, thin, dark keeled, segments 1 cm long; stamens uniform, shortly scabrid; ovary with ca 6 ovules per cell. *Capsule* unknown.

Flowering Period: September.

DISTRIBUTION: Only known from type locality.

CAPE.—Calvinia, Lokenburg, Stinkfontein hills, on flat top; arid fynbos vegetation, *Acocks* 18550 (PRE, holo.!).

A graceful, grass-like plant distinguished from *T. esterhuysenae* by its pubescence, and the longer pedicels. Moreover the ovary contains 6 ovules per cell, not 2.

8. *T. reflexipilosa* (O. Ktze.) Oberm., comb. et stat. nov.

*A. filiformis* Thunb. var. *reflexipilosum* O. Kuntze, Rev. Gen. 3, 2: 315 (1898). Type: Natal, Charlestown, *Otto Kuntze* s.n. (K, holo.).



Setose, robust, many-leaved plants up to 70 cm high. *Roots* many, wiry, thin. *Rhizome* small woody. *Leaves* linear-lanceolate, up to 45 cm long, 8 mm broad, flat or slightly rolled, upper surface glabrous, lower ribbed, retrorsely fulvous setose on margin and ribs, seldom nearly glabrous. *Inflorescence* a simple, many-flowered, tall raceme, up to 1 m high; scape terete, retrorsely setose especially near the base and when immature; rhachis glabrous; bracts small, subulate, surrounding pedicel, fimbriate; pedicels slender up to 25 mm long in fruit, glabrous, irregularly spaced along rhachis and spreading haphazardly in all directions. *Flowers* with perianth segments spreading, 1 cm long; filaments scabrid, uniform; ovary with 6 ovules per cell. *Capsule* globose, 4 mm in diam. contracted at the base, glabrous. *Seeds* (immature) with oblong white raphides (?) on skin.

Flowering Period: October–March.

DISTRIBUTION: Northern Natal, Swaziland, eastern Transvaal, eastern Southern Rhodesia, on moist grassland, swamps or black turf.

NATAL.—Vryheid: *Burt Davy* (PRE, 11470).

SWAZILAND.—Mbabane, Forbes Reef Road, swamp, *Compton* 27574. (PRE); Hull's Farm, *Compton* 25431 (PRE).

TRANSSVAAL.—Lydenburg: *Wilms* 1507 (PRE, L). Pilgrims Rest: Graskop, *Galpin* 14480 (PRE). Nelspruit: Mauchsberg, *Sabie, Smuts & Gillett* 2289 (PRE). Barberton: Shiya-lo-ngubo Dam, *Codd* 6426 (PRE). Witbank: Springbok Colliery, *Kies* 388 (PRE).

SOUTHERN RHODESIA.—Melsetter: Chimanmani Mts., Mt. Poza, grasslands, *Goodier* 509 (SRGH, PRE).

A mountain grassland species resembling *T. saltii* but distinguished by the long, reflexed tawny hairs, which are characteristic especially on the young racemes emerging from between the leaves. The thin, untidily straggling pedicels are also typical. In drying the plants usually turn black.

9. *T. margaretæ* *Oberm.*, sp. nov., *T. saltii*, affinis, sed ovario piloso differt.

*Plantæ* graminiformes gregariæ. *Radices* fibrosæ duræ. *Folia* filiformia leviter hirsuta pilis patentibus. *Racemi* simplices, primum prope apicem floribus congesti, scapo sub anthesi extendo. *Ovarium* hispidum pilis longis erectis indutum; ovula in lociis 4–6.

Hard, grasslike plants growing in clumps up to 60 cm high. *Roots* hard, thin, woody. *Rhizome* small, woody. *Leaves* terete or linear, up to 40 cm long, 2 mm broad, canalliculate or rolled, ribbed, hard, sparsely hairy with small patent hairs or nearly glabrous, leaf-bases persistent as fibres. *Inflorescence* simple, glabrous, flowers at first congested near the apex, rhachis elongating during anthesis; scape terete; bracts small, clasping the pedicel, subulate, fimbriate; pedicels ascending, up to 12 mm long. *Flowers* with white, glabrous perianth segments 1 cm long; filaments very shortly scabrid; ovary densely covered with long erect hairs; ovules 4–6 per cell. *Capsule* not seen.

Flowering Period: August–November.

DISTRIBUTION: Natal, eastern Transvaal to Woodbush Mts., apparently in damp grassveld.

TRANSSVAAL.—Barberton: Saddleback Mountain, summit, damp hollows, *Galpin* 538 (PRE, holo.). Nelspruit: *Sabie, Pole Evans* (PRE, 28725, SRGH). Pietersburg: Woodbush Mts., grassveld, *Moss* 15434. (PRE, J).

NATAL.—Utrecht: Tweekloof, *Thode* A388 (PRE). Estcourt: Cathedral Peak, *Esterhuysen* 15464 (BOL).

The species is closely related to *T. saltii* but the hairy ovary is a very unusual feature. Professor C. E. Moss named the plant *margaretæ* after his wife, but he did not publish the name.

10. *T. affinis* Kunth, Enum. 4: 579 (1843). Type: Cape, Port Elizabeth, Addo, Drège 8727 (P, iso., PRE, photo.).

*Anthericum affine* Bak. in J. Bot. Lond. 10: 138 (1872).\*

*A. pubescens* Bak. in J. Linn. Soc. 15: 309 (1876) et in Fl. Cap. 6: 390 (1897). Type: Cap., Mountain grassland near Somerset East, MacOwan 1589 (K, holo.). *A. pudicum* Bak. in Fl. Cap. 6: 388 (1897). Type: Cap., Uitenhage, amongst shrubs near the Zwartkops River, Zeyher 1070 (K, holo., BOL, PRE, iso.). *A. longiciliatum* Poelln. in Bol. Soc. Brot. 16, 2: 54 (1942). Type: Cape, Bathurst, Trapp's Valley, Daly 561 (B, holo.! PRE, photo., GRA, iso.). *A. pseudofalcatum* Poelln. in Bol. Soc. Brot. 16, 2: 63 (1942). Type: Cape, Port Elizabeth, Zwartkops River, Ecklon & Zeyher, Aspod. 113 (B, holo., PRE, photo.). Poellnitz in his description mentions that the collector and locality were unknown; apparently he was unaware of the Ecklon & Zeyher system of numbering places. *A. longifolium* var. *burchellii* Bak. in J. Linn. Soc. 15: 312 (1876) et in Fl. Cap. 6: 394 (1897). Type of var.: Cape, Port Alfred, Burchell 3795 (K, holo.).

Slender or fairly robust plants up to 1 m high, solitary or a few together. *Roots* wiry. *Rhizome* small. *Leaves* erect, somewhat fleshy, semiterete to linear, tapering towards the apex, canaliculate above, up to 40 cm long, 8–16 mm broad, usually glabrous, occasionally margin ciliate or lamina pubescent; mouth of tubular base fimbriate. *Inflorescence* erect, branched, laxly flowered up to 1 m high; scape somewhat compressed, pubescent; bracts small, ovate, acuminate; pedicels usually up to 16 mm long in fruit (up to 4 cm in one variety), erect. *Flowers* white with spreading perianth segments 12 mm long, immaculate; filaments scabrid; ovary with 6 ovules per cell. *Capsule* globose, 5 mm in diam. *Seeds* smooth.

*Flowering Period*: September–June. Flowers sometimes opening fairly early in the day, sweet smelling.

*DISTRIBUTION*: Humansdorp to Durban, in clearings or on grassy slopes near the coast.

CAPE.—Humansdorp: Eerste River, Fourcade 1186 (BOL); Hankey, Fourcade 3328 (PRE). George: Sinka Bridge, Wasserfall (PRE). Uniondale: Joubertina, Esterhuysen 7099 (BOL); Haarlem, Esterhuysen 6034 (BOL). Bathurst: Port Alfred, Rogers 28057 (GRA); Tyson (BOL 25743, GRA 10, PRE, in Herb. Marloth 8510); Acocks 17692 (PRE). King William's Town: Tyson 3072; Sim 1513 (BOL); Galpin 5955 (PRE). Albany: Grahamstown, Daly & Sole 100 (GRA); 319 (PRE); Britten 5169, 5137 (GRA); near Grahamstown, Dyer 2108 (GRA); Botha's Hill, Lotsy & Goddyn 149, 171 (L). Kentani: Nobongubo, Pegler 1397 (GRA); Qolora Mouth, grassy slopes, Pegler 1349 (BOL).

NATAL.—Umzinto: Scottburgh, in clearings along railway line, Mauve 4050 (PRE). Claremont: Wood 7727 (NH).

The species is variable in size, pubescence and width of leaf, no doubt due to the variation in climate. The specimens from George are usually smaller and more pubescent than those from the warmer Natal South Coast. Some collectors record that the plants appear after veld fires which stimulate early development. As a result of injuries, usually from veldfires, the side branches of the raceme are often mutilated and remain as small bracteate buds near the base of the scape. The apical bud however, probably originally protected by the tissues of the side-branches, is stimulated to develop into a long, densely flowered, simple raceme becoming prostrate with age. This traumatic form was described by von Poellnitz as a separate species, *A. pseudofalcatum* and by Baker as a variety, var. *burchellii*, of *A. longifolium*. Baker thought that the

\* Baker places here *A. filiforme*  $\beta$ , Thunb. (L, holo., PRE, photo). I have not seen the actual specimen but this appears to be correct. In J. Linn. Soc. 15: 308 (1876) Baker makes it a variety, var. *affinis*, of *A. jacquinianum* Schult. f.

small bracteate buds, that is the injured, sterile side-branches, could give rise to new plants ("scapi elongati, decumbentes, pilosi, e nodis vivipari"), but this is a wrong interpretation.

Some specimens from the Cape, e.g. *Archibald* 5697 from Alexandria district, Langebosch Height, in pine plantations; *Acocks* 17692 from Bathurst district, Port Alfred, West Bank, flats below dunes, possess very long pedicels, reaching a length of up to 4 cm.

# 11. *T. brachypoda* (Bak.) Oberm., comb. nov.

*Anthericum brachypodum* Bak. in Fl. Cap. 6: 389 (1897). Duthie in Ann. Stell. Univ. 4, A: 10, t.II, fig. 4, 5 (1926). Adamson & Salter, Flora of the Cape Peninsula 183 (1950). Type: Cape, sand dunes near Cape Town, *Bolus* 3921 (K, holo.).\* *A. lowryense* Bak. in Bull. Herb. Boiss. Ser. 2, 4: 996 (1904). Type: Cape, Somerset West, Sir Lowry's Pass, *Schlechter* 5364 (Z, holo!, B, GRA, iso!). *A. obtusifolium* Poelln. in Bol. Soc. Brot. 16, 2: 74 (1942). Type: Cape, Table Mountain, 1/17, *Bergius* (B, holo!, PRE, photo.). *A. validum* Poelln. in Bol. Soc. Brot. 16, 2: 79 (1942). Type: Cape, Malmesbury, near Hopefield, *Bachmann* 811 (B, holo!, PRE, photo.). *A. submaculatum* Poelln. in Bol. Soc. Brot. 16, 2: 78 (1942). Type: Cape, Swellendam, Rhenosterkop, *Schlechter* 10575 (B, holo!, PRE, photo.). There are only two buds on the plant. Von Poellnitz described the flower from a detached one in a capsule and noted it to be maculate. I doubt whether it belonged to this plant for *T. brachypoda* is immaculate. *A. tenuifolium* Adams. in J. S.A. Bot. 9: 137 (1943); Adamson & Salter, Flora of the Cape Peninsula 183 (1950), nom. nov. for *A. stenophyllum* Adamson (non Bak.) in J. S.A. Bot. 7: 189 (1941). Type: Cape Peninsula, Smitswinkel Bay, *Adamson* 3128 (BOL, holo!). *A. brachypodum* Bak. var. *caespitosum* Adamson in J. S.A. Bot. 7: 189 (1941). Adamson & Salter, Flora of the Cape Peninsula, 183 (1950). Type of var.: Cape Peninsula, between Rondebosch & Kenilworth, *Adamson* 2789 (BOL, holo.).

Plants up to 70 cm high, xerophytic, solitary or in clumps. *Roots* many, whitish, thin or slightly swollen at times. *Rhizome* horizontal, unbranched or branched, forming clumps of plants. *Leaves* 4–12 per tuft, often persisting for a long time, erect, linear, 20–50 cm long, 2–4 mm wide, sclerotic, ribbed, glabrous, the margins usually raised, yellow, occasionally with a spiral twist; sometimes outer leaves consisting of a membranous sheath only without a lamina. *Inflorescence* usually much taller than the leaves, branched or reduced to a simple raceme; lowest branches with unequal, accessory branches, scape terete, firm, shiny; bracts small, deltoid apiculate; pedicels short, up to 4 mm long in fruit, erect. *Flowers* with perianth immaculate, white, rotate; segments ca. 8 mm long; ovary with 4 ovules per cell; *Capsule* globose, ca. 5 mm in diam. *Seeds* ca. 2 mm in diam. black, minutely verrucose (mature?).

Flowering Period: October–April.

**DISTRIBUTION:** Cape Peninsula and surrounding districts, "damp sandy soils with humus" (*Adamson*); on Stellenbosch Flats in sandy stony places, locally frequent (*Duthie*).

**CAPE.**—Peninsula: Table Mountain, *Esterhuysen* 11680 (BOL); Constantia Corner, *Salter* 7164 (BOL); Vygekraal, *Wolley Dod*, 5577 (BOL). Stellenbosch: S.W. of Stellenbosch, *Salter* 2049 (BOL). Bredasdorp: Struys Bay, *Esterhuysen* 4387 (BOL). Swellendam: Rhenoster Hills, *Marloth* 12034 (PRE).

\* In the Flora Capensis, *Ecklon & Zeyher*, Asphod. 106, from mountains near Simonstown, is also cited. Mr. W. Marais, who examined this specimen at K found it to be correctly named. In the Berlin Herbarium this number represents a plant of *A. hirsutum* Thunb. together with a detached inflorescence of an *Urginea* species. This collection was described by von Poellnitz as *A. praetermissum*, in Bol. Soc. Brot. 16, 2: 62, 1942, a nomen confusum, cf. p. 579.



Adamson separated those plants with persistent leaves growing in dense tufts, and with leaf margins not thickened, into the variety *caespitosum*. Duthie, who studied this species around Stellenbosch, noted that the leaves persisted long after flowering and that they sometimes formed tufts but she did not recognize two distinct varieties. It is the only species from the south western Cape to flower in summer.

12. *T. tabularis* (Bak.) Oberm., comb. nov.

*A. tabulare* Bak. in Fl. Cap. 6: 391 (1897). Adamson & Salter, Flora of the Cape Peninsula, 182 (1950). Type: Cape, Table Mountain, Bolus 4726 (K, holo., BOL, iso.). *A. palustre* Adamson in J. S.A. Bot. 7: 187, fig. 1 (1941); Adamson & Salter, Flora of the Cape Peninsula, 183 (1950). Type: Cape Peninsula, Patrys Vlei, Salter 8472 (BOL, holo.). *A. glabrum* Adamson in J. S.A. Bot. 7: 100 (1941); Adamson & Salter, Flora of the Cape Peninsula 182 (1950). Type: Cape Peninsula, Steenberg, Adamson 2768 (BOL, holo.).

Solitary, glabrous plants variable in size, up to 100 cm tall but usually much smaller. *Roots* wiry, thin. *Rhizome* small, woody. *Leaves* many, forming a basal, erect rosette: outer leaves smaller, often consisting only of a tubular sheath without a lamina; lamina of produced leaves linear to semi-terete, up to 50 cm long, 2–10 mm broad, long tapered in upper half, ribbed, margin minutely denticulate. *Inflorescence* divaricately few-branched or simple; lowest branches showing suppressed accessory branches; scape usually about as long as the leaves, firm, terete, arcuate; side-branches curved upwards, densely flowered near the top; bracts small, 5 mm, acuminate; a few sterile bracts from suppressed side-branches often present on scape; pedicels erect, up to 1 cm in fruit, those of dropped sterile flowers recurved. *Flowers* with perianth immaculate, white often tinged with pink; segments 14 mm long; ovary with 6 ovules per cell. *Capsule* globose, succulent, glabrous, sulcate 9 mm long. *Seed* rough, with 3 large crenulate ridges or wings.

Flowering Period: August–September.

DISTRIBUTION: Known only from Table Mountain and surrounding mountains at fairly high altitudes, often on wet cliffs.

CAPE.—Peninsula: Patrys Vlei, Salter 8534 (BOL); Cirkels Vlei, Leighton 667 (BOL); Kommetjie near Simonstown, Galpin 4749 (PRE). Table Mountain, Marloth 776 (PRE), 14056 (PRE), Haagner (Conrath 778, GZU). Caledon: Berg, Kleinmond, de Vos 231 (BOL).

In the herbarium, Adamson's two species, *A. glabrum* and *A. palustre* could not be separated from *T. tabularis*. They may be forms however that show differences in their natural habitat.

13. *T. hirsuta* (Thunb.) Kunth, Enum. 4: 577 (1843).

*Anthericum hirsutum* Thunb., Prod. 63 (1794) et in Fl. Cap. ed. Schult. 322 (1823). Bak. in J. Bot. Lond. 1872: 139 et in Fl. Cap. 6: 394 (1897); Duthie in Ann. Stell. Univ. 4, A: 8, t2, fig. 1, 10 (1926); Adamson & Salter, Flora of the Cape Peninsula, 182 (1950). Type: Cape, Thunberg (UPS, holo., PRE, photo.).

*T. corymbosa* Kunth, Enum. 4: 577 (1843). Type: Cape, Table Mountain, Drège 8716 (P. iso., PRE, photo.). In E. Meyer's Zwei Pflanzengeogr. Documente, Drège 8716 was said to have been collected in the Tulbagh district, Klein Drakenstein between Berg River and Drakenstein Berge but the Paris specimen gives the locality as Table Mountain.

Plants up to 60 cm high. *Roots* thin, wiry, many, slightly swollen in spring. *Rhizome* small, compact. *Leaves* 4–6 per shoot, subdistichous, arranged in an erect fanlike manner, linear to broadly linear, 7–40 cm long, 5–20 mm broad, flat, striate, pubescent, firm, dark green, 2 inner smaller falcate; the basal tube often produced into a prominent triangular point opposite the lamina; outer leaves often short, or without a lamina. *Inflorescence* taller than the leaves, with a few ascending branches,



the lowest axils showing buds of suppressed, accessory branches, rarely simple; scape arcuate, firm, woody, pubescent, 30–40 cm long; racemes laxly flowered, elongating during anthesis; bracts small, subulate, ciliate; pedicels erect, up to 1 cm long and curving inwards in fruit. *Flowers* with perianth rotate, immaculate; segments 10–12 mm long; stamens spreading; ovary with 6 ovules per cell. *Capsule* globose, 6 mm, glabrous. *Seed* verrucose, grey, 3 mm.

Flowering Period: September–October.

DISTRIBUTION: A mountain species found on the Peninsula and surrounding districts.

CAPE.—Cape Town: Devils Peak, *Bolus* 3794 (BOL); Peninsula, *Kuhl & van Hasselt* [L, 909, 84 (261)]; Kenilworth Race Course, *Salter* 7714 (BOL). Caledon: Koude Rivier, *Schlechter* 9730 (B, BOL, L.). Stellenbosch: *Duthie* 653 (BOL). Paarl: Hercules Pillar, flats at the North base, *Leighton* 558 (BOL). Malmesbury: near Darling, *Esterhuysen* 3873 (BOL). Piketberg: near Goedverwacht, *Bolus* (BOL, 25730).

Baker refers *Burchell* 4118 from the Bathurst district, Theophilis, to this species and mentions that it is a form with prostrate “viviparous” flowering stems. Although I did not see this specimen, I suspect that it is *T. affinis* Kunth, or possibly *T. ciliata*. *T. hirsuta* does not occur so far east.

The species was found in an unusual habitat in the Caledon district, near Bot River Lagoon, next to running water in a marshy area, growing in clumps; plants luxuriant, flowering profusely, September 1960, *Mauve* 4070 (PRE, NBG).

## Section 2. TRACHYANDRA.

### 14. *T. chlamydophylla* (Bak.) Oberm., comb. nov.

*Anthericum chlamydophyllum* Bak. in Fl. Cap. 6: 389 (1897); *Duthie* in Ann. Stell. Univ. 4, A; 14, t.II, fig. 2, 11 (1926); Adamson & Salter, Flora of the Cape Peninsula 181 (1950). Type: Cape, Tulbagh Kloof, *MacOwan* 2603 (K, holo.).

Plants up to 70 cm high. *Roots* many, all alike, hard, thick, often covered with a tomentum of thick, long, felted root hairs. *Rhizome* compact, hard. *Squamiae* brown, narrow tubular, several surrounding one leaf or scape (but none surrounding a shoot). *Leaves* numerous, terete or subterete, 30–70 cm long, 3–5 mm in diam. usually erect and straight, glabrous or slightly muricate, ribbed. *Inflorescence* a simple raceme with ca. 30 flowers, compact at first and shorter than the leaves, ultimately longer and then usually prostrate and falsely secund; scape arcuate at the base with a few sterile bracts (vestiges of suppressed side-branches); fertile bracts subulate, up to 7 mm long; pedicels patent, lengthening during anthesis, curved downwards near the base then spreading, up to 28 mm in fruit; scape and pedicels thickening markedly in fruiting stage. *Flowers* with perianth rotate, immaculate; segments 10–13 mm long; filaments subequal, erect or spreading; ovary with 4 ovules per cell. *Capsule* globose, ca. 8 mm in diam., persistent perianth-base wide, slightly scalloped. *Seeds* tetrahedral, 3–5 mm in diam.

Flowering Period.—August–November. Sweet scented.

DISTRIBUTION.—Cape Peninsula and surrounding districts. Although the type locality was stated to be Tulbagh Kloof, no subsequent collections were made from this area. *Duthie* remarks that it grows most luxuriantly on well-drained, sandy soil; when it occurs in other situations it is often much stunted.

CAPE.—Wynberg: Wynberg Hill, *Salter* 8993 (PRE) 8786 (BOL). Kirstenbosch, *Barker* 2607 (PRE). Stellenbosch: Faure, *Esterhuysen* 11927 (PRE, BOL). Paarl: Klapmuts, *Häfstrom & Acocks* 188 (PRE). Malmesbury: Mamre, *Leighton* 1822 (BOL). Worcester: Botha's Halt, *Gillett* 276 (BOL).

15. *T. hispida* (L.) Kunth, Enum. 4: 575 (1843).

*Anthericum hispidum* L., Spec. Pl. ed. 2 (1762); Jacq. Coll. Suppl. 91; 1c. 2: 17 t.409 (1786–1793); Thunb., Prod. 63 (1794) et in Fl. Cap. ed. Schult. 321 (1823); Willd., Spec. 2: 145 (1799); Bak. in Fl. Cap. 6: 393 (1897); Duthie in Ann. Stell. Univ. 4, A: 7, t.II, fig. 3, 7, 8 (1926); Adamson & Salter, Flora of the Cape Peninsula, 181 (1950). Type: Cape, *Thunberg* (Linn. H. Cat. 432–23, syn.; 432–24, syn., LINN. herb. PRE, photo.). I propose making this also the type species of the genus. *A. squameum* L.f., Suppl. 202 (1781). Roem. et Schult., Syst. Veg. 7: 481 (1829). Type: Cape, *Thunberg* (Linn. Herb. Cat. 432–22; LINN. holo., PRE, photo.). *A. undulatum* Thunb., Prod. 63 (1794) et in Fl. Cap. ed. Schult. 321 (1823); Willd., Spec. Plant 2: 140 (1799). Roem. & Schult., Syst. Veg. 7: 470 (1829). Type: Cape, *Thunberg* (LINN. Cat. no. 432–24, holo., UPS, iso., PRE, photo.). *A. paradoxum* Roem. & Schult., Syst. Veg. 7: 459 (1829). Type: Cape, without locality or collector (M, holo., PRE, photo.). The specimen bears a label with “1623” on it. *A. subpilosum* Poelln. in Bol. Soc. Brot. 16, 2: 64 (1942). Type: Cape, Piketberg, Piqueniers Kloof, *Schlechter* 10748 (B, holo., GRA, iso, PRE, photo.). *A. congestum* Adams. in J. S.A. Bot. 10: 133 (1944); Adamson & Salter, Flora of the Cape Peninsula, 181 (1950). Type: Cape, Claremont, *Salter* 8762 (BOL, holo.). The number 8767 in the text is a misprint.

*Phalangium squameum* (L.f.) Poir. in Lam. Encyc. 5: 246 (1804).

*Arthropodium hispidum* (L.) Spreng. Syst. 2: 87 (1825).

*Bulbinella? squamea* (L.f.) Kunth, Enum. 4: 573 (1843).

*Trachyandra undulata* (Thunb.) Kunth, l.c. 583. *T. paradoxa* (R. & S.) Kunth, l.c. 576.

Small plants usually solitary or occasionally in clumps up to 30 cm high. *Roots* fleshy, swollen above, very irregular with numerous, filiform secondary roots. *Rhizome* small. *Squamae* membranous, large, surrounding a whole shoot as well as the base of the leaves and the scape individually, gaping, membranous, white. *Leaves* 2–5 per tuft, linear to linear-lanceolate, 6–45 cm long, 2–10 mm broad, straight or with a lax twist or occasionally, plicately folded, thin, flat, glabrous or hispid, often with a purple margin, glaucous, erect or prostrate. *Inflorescence* a simple, congested raceme; peduncle at first short, lengthening during flowering, 2–28 cm long, hispid or glabrous; bracts large, ovate-lanceolate, acuminate, up to 15 mm long, membranous; pedicels up to 3 cm long, hispid, curving down in fruit. *Flowers* with perianth hispid on outside, pinkish white, slightly spreading, immaculate; segments ca. 1 cm long; stamens dimorphous, filaments pink, inner more muricate than outer, ciliate at the base; ovary with 8 ovules per cell. *Capsule* ovate, glabrous, 4 mm. *Seed* 2 mm in diam.

Flowering Period: June–September; sweet smelling.

DISTRIBUTION: Cape and neighbouring districts; occasional on seasonally damp flats and lowest slopes on the Peninsula according to Adamson.

CAPE.—Cape Town: *Marloth* 165 (PRE), *Haagner* in herb. *Conrath* 1241 (GZU); Claremont Royal Observatory, *Adamson* 2950 (PRE); Rondebosch, *Bolus* 3731 (BOL), *Salter* 8762 (GRA, BOL); Wynberg, *Schlechter* 1060 (GRA); Green Point, *Tyson* (GRA). Caledon: Rivier Sonder Einde Mountains, *Wilman* 542 (BOL). Malmesbury: Mamre Hills, *Barker* 4606 (BOL). Stellenbosch: *Burmester* (GZU), *Duthie* 533 (BOL). Worcester: *Stettyn*, *Leipoldt* 3384 (BOL). Clanwilliam: Doorn Rivier, *Schlechter* 8055 (B, BOL, PRE, L.). Hopefield: *Bolus* 12871 (BOL, NH).

Adamson records that the tubers may form buds giving rise to new shoots. He separated his species *A. congestum* because of its short peduncle whilst he also found it growing in clumps. Duthie found these various forms around Stellenbosch but did not separate them.

16. *T. peculiaris* (Dinter) Oberm., comb. nov.

*Anthericum peculiare* Dinter in Fedde, Rep. 29: 263 (1931); Poelln. in Fedde, Rep. 52: 254 (1943). Type: South West Africa, Lüderitz: Halenberg, 40 m. E. of Lüderitz Bay on a steep, hot slope of a mica schist mountain, Dinter 6651 (B, holo.! PRE, photo.).

Small plants up to 10 cm long. *Roots* tuberous, fused together and with the rhizome. *Squamae* short membranous white, gaping. *Leaves* few, linear, 10 cm long, 4 mm wide, glabrous. *Inflorescence* a congested raceme, many flowered; scape 6 cm long, hirsute; bracts ovate, white, membranous, glabrous, margins fimbriate; pedicels recurved in fruit, hirsute, up to 12 mm long. *Flowers* with a white perianth, segments 6 mm long, sparsely hirsute outside. *Capsule* glabrous, 5 mm long. *Seeds* black, verrucose,  $1\frac{1}{2}$  mm in diam., tetrahedral.

Flowering Period: In fruit, August.

DISTRIBUTION: Only known from type specimen, collected at Halenberg, South West Africa.

SOUTH WEST AFRICA.—Lüderitz: Halenberg, 40 m. E. of Lüderitz Bay on a steep, hot slope of a mica schist mountain, Dinter 6651 (B, holo.! PRE, photo.).

Very near *T. hispida* (L.f.) Kunth but with small glabrous bracts and apparently geographically isolated from the Cape species. Dinter found only four plants which were in fruit. So far not collected again.

17. *T. hirsutiflora* (Adamson) Oberm., comb. nov.

*Anthericum hirsutiflorum* Adamson in Journ. S.A. Bot. 7: 98 (1941); Adamson & Salter, Flora of the Cape Peninsula, 181 (1950). Type: Cape, Wynberg, Bolus 3448 (BOL, holo.). *A. pilosissimum* Poelln. in Bol. Soc. Brot. 16, 2: 61 (1942). Type: Cape, Muizenberg, Wilms 3759 (B, holo.! PRE, photo.). *A. canaliculatum* sensu Bak. (non Aiton) in J. Linn. Soc. Bot. 15: 309 (1876) et in Fl. Cap. 6: 391 (1897).

Hairy plants up to 60 cm high. *Roots* many, swollen, spreading, yellow. *Rhizome* small. *Squamae* surrounding shoots as well as leaf- and scape-bases, tubular, membranous. *Leaves* 2–4 per shoot, subterete, canaliculate, up to 50 cm long, 2 mm in diam. hard, striate, scabrid. *Inflorescence* a tall simple tomentose raceme, sometimes elongating to form a second set of flowers; scape terete, purple, covered with white, straggling hairs; bracts narrow ovate, subulate, hairy; pedicels densely hairy, erect, up to 3 cm in fruit. *Flowers* with cupshaped perianth, densely hairy, pink or pale mauve on outside, immaculate, segments 12 mm long; stamens shortly scabrid; ovary hairy, with 10 ovules per cell. *Capsule* dark purple, globose, hairy, 15 mm in diam.

Flowering Period: June–October.

DISTRIBUTION: Cape Peninsula and surrounding districts. According to Adamson it is found in sand, generally amongst rocks, at low altitudes, flowering most freely after fires.

CAPE.—Wynberg: Kenilworth, Salter 7734 (BOL); Tokai, Guthrie 1131 (BOL). Simons-town: Laubner (in Herb. Conrath 662, GZU), Wright 214 (L); Red Hills, Lam & Meuse 4125 (L). Paarl: Franschhoek Mountains, Phillips 8549 (BOL). Caledon: near Stanford, Acocks 15500 (PRE). Clanwilliam: lower Olifants River, Marloth 8391 (PRE).

Baker confused this species with *Anthericum canaliculatum* Ait., which is a synonym of *A. ciliatum* L.f., a very different species. The rough woolly pubescence and the erect fruiting pedicel easily distinguish it from *T. ciliata* and *T. hispida*.

18. *T. ciliata* (L.f.) Kunth, Enum. 4: 585 (1843).

*Anthericum ciliatum* L.f., Suppl. 202 (1781). Thunb., Prod. 63 (1794) et Fl. Cap. ed. Schult. 324 (1823); Willd. Spec. Plant. 2: 146 (1799). Bak. in J. Bot. Lond. 1872: 139 et in Fl. Cap. 6: 396 (1897). Adamson & Salter, Flora of the Cape Peninsula, 182 (1950). Type: Cape, Thunberg (UPS, holo., PRE, photo.). *A. canaliculatum* Ait., Hort. Kew. 1: 448 (1789) et Hort. Kew. ed. 2: 268 (1811).



Willd., Spec. Plant. 2: 141 (1799). Ker Gawler in Bot. Mag. t. 1124 (1808). Lindley in Bot. Reg. t. 877 (1825) under var. *rufum*. Roem. & Schult., Syst. Veg. 7: 460 (1829). Kunth, Enum. 4: 578 (1843). Type: Cape, Introduced to Kew by Francis Masson in 1774 (BM, holo., PRE, photo.). *A. longifolium* Jacq. Coll. Suppl. 92; Ic. 2: 18, t. 413 (1786-1793). Willd. Spec. Plant. 2: 139 (1799). Roem. & Schult., Syst. Veg. 7: 464 (1829). Type: Iconotype, Cape, Jacquin, Ic. t. 413. *A. vespertinum* Jacq., Hort. Schoenbr. 1: 44, t. 85 (1804). Roem. & Schult., Syst. 7: 464 (1829). Ker Gawl. Bot. Mag. t. 1040 (1807). Type: Iconotype, Jacquin, Hort. Schoen. t. 85. *A. blepharophoron* Roem. & Schult., Syst. Veg. 7: 461 (1829). Type: Iconotype, Jacquin, Hort. Schoenbr. t. 413. *A. falcatum* sensu Bak. in Fl. Cap. 6: 394 (1897) as to Burchell 4076, non L. *A. recurvatum* Dinter in Fedde, Rep. 29, 264 (1931). Poelln. in Fedde, Rep. 52: 255 (1943). Type: South West Africa, Diamond Area I: Klinghardt Mountains, Dinter 3960 (B, holo.! PRE, photo.). *A. pilosiflorum* Poelln. in Bol. Soc. Brot. 16, 2: 60 (1942). Type: Cape, Namaqualand, Brakdam, Pearson 5948 (B, holo., probably destroyed) including var. *subpapposum* l.c. Type var.: Cape Peninsula, Bergius (B, holo! PRE, photo.). *A. spongiosum* Poelln. in Bol. Soc. Brot. 16, 2: 65 (1942). Type: Cape, van Rhynsdorp, Zout Rivier, Bergius (B, holo! PRE, photo.). *A. hamatum* Poelln. in Bol. Soc. Brot. 16, 2: 67 (1942). Type: Cape, Hopefield, Bachmann 801 (B, syn. probably destroyed); Riversdale, Rust 565 (B, syn! PRE, photo.). *A. maculatum* Poelln. in Bol. Soc. Brot. 16, 2: 73 (1942). Type: Cape, Clanwilliam, Packhuisberg, Schlechter 10811 (B, holo! GRA, PRE, L, iso!). *Phalangium canaliculatum* (Ait.) Poir. in Lam. Enc. 5: 249 (1804). *P. longifolium* (Jacq.) Poir. l.c. 243. *P. vespertinum* (Jacq.) Poir. l.c. 249. *Bulbine ciliata* (L.f.) Link, Enum. 1: 329 (1821). Roem. & Schult. in Syst. Veg. 7: 450 (1829). *B. canaliculata* (Ait.) Spreng., Syst. 2: 86 (1825). *Trachyandra blepharophora* (Roem. & Schult.) Kunth, Enum. 4: 582 (1843). *T. bracteosa* Kunth, Enum. 4: 582 (1843). Type: Cape, Saldanha Bay, between Dassenberg & Groenekloof, Drège 1493 (L, iso! PRE, photo.). \*

Plants variable in size, up to 50 cm high. *Roots* swollen and spongy but not fused, becoming thinner and harder later in the season. *Rhizome* discoid, small. *Squamae* membranous, thin, white, surrounding shoot as well as leaf- and scape-bases. *Leaves* variable, linear, up to 100 cm long and 4 cm broad, dull glaucous, with a juicy, spongy mesoderm, soft, flat or keeled with some scattered hairs on margin and keel or glabrous. *Inflorescence* branched with 1-2 basal branches or simple (through reduction), erect at first, sometimes elongating during anthesis and becoming prostrate; scape pubescent at first, glabrous with age, with some sterile bracts or vestiges of suppressed side-branches; bracts large, boatshaped, 1 cm long, dark, subulate, auriculate, margin minutely ciliate the young, compact racemes with the imbricate, subulate bracts resembling an ear of corn; pedicels 8 mm long in flower, erect, up to 2 cm long in fruit and then recurved and sub-second. *Flowers* with a recurved, translucent, white perianth; segments ca. 1 cm long, often hairy outside, with yellow spots near the base (these sometimes faint); the outer stamens erect, scabrid, the inner connivent around the ovary, retrorsely scabrid in lower half; ovary with 10 ovules per cell. *Capsule* ovoid to globose or cylindrical, glabrous, 6-14 mm long, slightly fleshy. *Seeds* black, minutely verrucose.

Flowering Period: August-September. Said to be scentless.

**DISTRIBUTION:** From the southern part of South West Africa to the south eastern Cape, usually near the coast in sand, occasionally further inland. Sometimes spreading as a weed around Cape Town.

**CAPE.**—Peninsula: Karbonkelberg, Leighton 704 (BOL); near Cape Town, Alberth (GZU). Hopefield: near Hopefield, Bolus 12872 (BOL). Clanwilliam: Schlechter 8422 (GRA). Piketberg: Piquenierskloof, Schlechter 10773 (GRA, L). Caledon: Gansbaai, Gillett 4406 (BOL). Knysna: Fourcade 1563 (GRA). Port Elizabeth:

\* Add to synonymy: *T. canaliculata*, *T. longifolia*, *T. vespertina*, l.c.



Walmer, *Cruden* 329 (GRA); New Brighton, *Paterson* 2146 (GRA). Bathurst: near Theopolis, *Burchell* 4076 (L.); this specimen is cited under *Anthericum falcatum* L.f. by Baker in *Flor. Cap.* 6: 394 (1897).

SOUTH WEST AFRICA.—Diamond Area I; Klinghardt Mts., *Dinter* 3960 (B, holo.! PRE, photo.).

Adamson in the *Journ. of S.A. Bot.* 7: 97 (1941) discusses the plates in the *Bot. Magazine* (t.1124) and *Bot. Register* (t.877). He found that Baker's *Anthericum canaliculatum* of the *Flora Capensis* really represented a new species, which he described as *A. hirsutiflorum*. But he could not place these two plates as he had not seen the type of *A. canaliculatum* Ait., which I consider a synonym of *T. ciliata*. As Curtis mentions in the text that the plant was introduced by Masson and as Aiton himself refers to this plate, *Bot. Mag.* t.1124, in the second edition [*Hort. Kew.* 2: 268 (1811), under *A. canaliculatum*] it is likely that the plates were made from the old type plant or its offspring. After years in unnatural surroundings it had probably degenerated somewhat. Lindley called his plant var. *rufum* as the pedicel and the "interior" of the flower was hairy. He must have meant the exterior of the flower. He described the filaments as smooth but this might have been a careless observation. Both Curtis and Lindley suggested that the species might be identical with *Trachyandra hirsuta* but this species is different; it has wiry roots, broader leaves, etc.

19. *T. falcata* (L.f.) Kunth, *Enum.* 4: 586 (1843).

*Anthericum falcatum* L.f., *Suppl.* 202 (1781). Willd., *Spec. Pl.* 2: 138 (1799). Thunb., *Prod.* 63 (1794); et in *Fl. Cap.* 3d. Schult. 323 (1823). Type: Cape, *Thunberg* (UPS, holo., PRE, photo.). *Anthericum drepanophyllum* (Bak.) Schlechter ex *Index Kew.* 7: (1929); cf. Schlechter in *Schultze, Aus Namaland und Kalahari*, p. 202 with figure in text (1907). Schlechter refers this species to *Anthericum* but does not mention the *basionym*. Baker described it as *Chlorophytum drepanophyllum*. *Anthericum weissianum* Dinter in *Fedde*, *Rep.* 29: 262 (1931), Poelln. in *Fedde*, *Rep.* 52: 257 (1943). Type: South West Africa, north bank of Orange River, near its mouth, *Weiss* in herb. *Dinter* 6608 (B, holo.! PRE, photo.).

*Bulbine falcata* (L.f.) Roem. & Schult., *Syst. Veg.* 7: 451 (1829).

*Chlorophytum drepanophyllum* Bak. in *Fl. Cap.* 6: 398 (1897). Type: Cape, Namaqualand: near Nababep, *Bohus* 6584 (K, holo.).

Fairly tall, large plants up to 60 cm high. *Roots* very many, long, spreading, swollen in spring, covered with a thick tomentum of root hairs. *Rhizome* small. *Squamae* membranous surrounding the shoot, leaves and scape-base. *Leaves* usually 4, up to 30 cm long and 3–5 cm wide, falcate, flat, leathery, glabrous or shortly pubescent, margin minutely ciliate. *Inflorescence* an erect, branched, raceme with the branches ascending and with accessory branches, sometimes simple through reduction, overtopping the leaves, densely flowered; scape about as long as the raceme, terete, glabrous at the base, or hairy at first becoming glabrous, stout; lower bracts amplexicaul, short, forming a wide erect collar around the stem, apiculate, floral bracts widely ovate, subulate, membranous, white with a brown patch near the tips, closely imbricate in bud; pedicels short, 1 cm long, erect. *Flower* with perianth pale mauve, maculate; segments 12 mm long; stamens scabrid; ovary with 8–10 ovules per cell. *Capsule* turbinate, 12 mm long, apiculate, dry. *Seeds* grey, with raised hyaline margins.

Flowering Period: July–October.

**DISTRIBUTION:** Western Cape, coastal region from Saldanha to the southern part of South West Africa, in sandy soil. Collectors all found it to be common where they collected it. Schulze noted that it made a nice spinach. Marloth called it the wild cauliflower.

CAPE.—Hopefield: Saldanha Bay, *Bohnen* 1053 (PRE); Vredenburg, *Bohnen* 1054 (PRE). Clanwilliam: *Marloth* 5859 (PRE). Van Rhynsdorp: Klaver, *Andreae* 423 (PRE). Calvinia: Driefontein, Voor Hantam, *Marloth* 12818 (PRE). Laingsburg: Matjesfontein *Foley* 163 (PRE). Robertson: Vink River along road from Robertson to Worcester, *van Breda* 983 (PRE). Namaqualand: Richtersveld, Kavarass, *Marloth* 12423a (PRE); between Springbok and Hondeklip, *Dyer & Verdoorn* 1804 (PRE); Kamies Mountain, Garies, *Leistner* 742 (PRE); Lilyfontein, *Rodin* 1468 (PRE).

SOUTH WEST AFRICA.—Diamond Area I, north bank of Orange River near its mouth, Weiss in herb. *Dinter* 6608 (B, holo.! PRE, photo.).

20. *T. longepedunculata* (Steud. ex Roem. & Schult.) Kunth, Enum. 4: 584 (1843).

*Anthericum longepedunculatum* Steud. in Roem. & Schult., Syst. Veg. 7: 457 (1829). Bak. in J. Bot. Lond. 1872, 138 et in Fl. Cap. 6: 390 (1897). Duthie in Ann. Stell. Univ. 4, a: 12, t.1 (1926). Adamson & Salter, Flora of the Cape Peninsula, 180 (1950). Type: Cape, *Ludwig* (in herb. Steudel originally but it could not be traced with certainty).\*

*Anthericum revolutum* a in Herb. Thunberg (UPS); Juel, Pl. Thunb., 121 (1918) nom. Cape, *Thunberg* (UPS). This is the sheet to which Baker refers in J. Bot. 1872, 138.

Soft plants 18–60 cm high, solitary or several together. *Roots* swollen, ca. 7, contracted, not fused, whitish with numerous long thin rootlets. *Rhizome* small, compact. *Squamae* membranous, whitish, 15–30 cm high, surrounding the shoot as well as the leaf- and scape-bases. *Leaves* 2–8, subterete to linear, 11–40 cm long, 1–7 mm broad, tapering gradually to the apex, soft, glabrous or very minutely scabrid, dark green, often mottled near the base. *Inflorescence* 1–5 per plant, occasionally branched but usually simple through reduction, many flowered, often shorter than the leaves, elongating and falsely secund in fruiting stage; scape usually short, glabrous, or minutely scabrid, often reddish-brown and mottled near the base: sterile bracts (vestiges of suppressed branches) present; bracts boatshaped, cuspidate, sub-amplexicaul; pedicels short in bud, elongating to 3 cm in fruit and then patent, slightly recurved. *Flower* with perianth rotate, white to pinkish with reddish-brown keels, immaculate, segments 1 cm long, inner ciliate at the base; stamens with white filaments, inner with longer bristles, anthers orange; ovary with 9 ovules per cell. *Capsule* cylindrical, ca. 8 mm long, 3 mm in diam., thin walled, apiculate. *Seeds* black.

Flowering Period: August–October. “Sweet smelling, bee-pollinated” Duthie.

DISTRIBUTION: Cape Peninsula and surrounding areas, usually in damp marshy places at low altitudes.

CAPE.—Cape Town: Green Point, *MacOwan* 1986 (GRA); Claremont Sanatorium, *Wolley Dod* 2968 (BOL); Sassar, *Bohnen* 1063 (PRE). Malmesbury: Darling Flora Reserve, *Rycroft* 1995 (BOL). Stellenbosch: flats at Faure, *Esterhuysen* 11928 (BOL, PRE). Caledon: Stanford, *Compton* 19936 (BOL). Hopefield: near Hopefield, *Bolus* 12807 (BOL, PRE).

Adamson noted that the inflorescence did not lengthen in fruit but Duthie observed that it did. The herbarium specimens seem to indicate that they do lengthen during anthesis. The large forms seem to come very close to *T. ciliata*.

\* Mr. W. Marais who searched for the type at the Kew herbarium wrote the following: “There is no Ludwig specimen at Kew but there is one alleged to be from Lehmann. On this sheet is written ‘Lehmann’ in the hand of W. J. Hooker. Then a label ‘*Anthericum longepedunculatum* n. sp. C.B.S.’ in an unidentified hand. The ‘n. sp.’ leads one to think that it is by Steudel or by a person who wrote labels for him. Below this label ‘*Trachyandra longepedunculata* Kunth’ in the hand of Planchon. Then a note by N. E. Brown: ‘Matches the plant labelled in Herb. Thunberg *Anthericum revolutum* exactly’. The only suggestion is that this specimen is part of the Ludwig specimen which came to Hooker via Lehmann and that Baker knew about this. That would explain the citation of Ludwig and the omission of Lehmann by Baker in the J. Linn. Soc. 15: 138 and in the Flora Capensis 5: 390”.

21. *T. divaricata* (Jacq.) Kunth, Enum. 4: 580 (1843).

*Anthericum divaricatum* Jacq. Hort. Schoenbr. 4: 7, t.414 (1804); Roem. & Schult., Syst. Veg. 7: 463 (1829). Adamson & Salter, Flora of the Cape Peninsula, 184 (1950). Type: Iconotype, Jacquin, Hort. Schoenbr. 4: 7, t.414. *A. revolutum* (β) sensu Thunb., Prod. 62 (1794) et in Fl. Cap. ed. Schult. 318 (1823). Juel, Pl. Thunb. 121 (1918) nom. non L. *A. revolutum* sensu Ker Gawl. in Bot. Mag. t.1044 (1804) exclud. syn. non L. *A. revolutum* sensu Bak. in J. Bot. 1872, 138; in Trans. Linn. Soc. 15: 311 (1876) et in Fl. Cap. 6: 393 (1897), non L. *Phalangium aethiopicum* ramosum, floribus albis, petalis reflexis. Comm. in Hort. Amst. 1: 67, t.34 (1697).

Plants robust up to 90 cm high. *Roots* many, not much thickened, occasionally growing to a great depth. *Rhizome* woody, thick, irregular in shape. *Squamae* narrow, tubular, surrounding each leaf- and scape-base separately. *Leaves* linear, up to 100 cm long, 4–12 mm wide, tapering gradually to the apex, flat, glabrous, somewhat fleshy, flexible, erect or usually prostrate, straight or with a lax spiral twist, bright green occasionally orange at the base. *Inflorescence* stout, usually with accessory branches, divaricately branched; scape 10–50 cm high, stout glabrous; bracts small, 4 mm long, membranous, widely ovate at the base; pedicels 4–12 mm long. *Flowers* erect, perianth segments 7–12 mm long, white, green-keeled, with a yellow dot near the base, spreading, recurved from the middle; stamens yellow in lower half, dimorphous, 3 outer spreading, 3 inner connivent around ovary, spreading and retrorsely scabrid above; ovary with 12 atropous ovules per cell. *Capsule* globose, 12 mm in diam., slightly inflated, dry or somewhat fleshy, yellowish. *Seeds* 2 mm in diam. smooth, tetrahedral.

FLOWERING PERIOD: "August–September but also at other times; flowers opening in the morning". Adamson.

DISTRIBUTION: South western to south eastern Cape, common on sand and on dunes near the sea.

CAPE.—Namaqualand: Hondeklip Bay, *Pillans* 18254; 2 miles S. of Goodhouse, *Lewis* 64663 (NBG), *Barker* 6259 (NBG). Hopefield: Saldanha Bay, *Clarkson* 375. Cape: Blouberg Strand, *Bohnen* 1052 (PRE), *Compton* 8923, 8924 (NBG); Robben Island, *Walgate* 482 (PRE). Peninsula: Schusters Bay, *Lam & Meeuse* 4117 (L.); Kommetjie, *Eyles* 7741 (SRGH), Fishhoek, *Marloth* 2844 (PRE). Heidelberg: Witsand, *Gillett* 811 (BOL). Knysna: Plettenberg Bay, *Fourcade* 1051, 1489 (BOL), *Kapp* 114 (PRE). Bathurst: Port Alfred, *Rogers* 28052; *Hutton* 741.

Commelin's plate, t.34 in Hort. Amst. 1 (1697) is the oldest drawing of a *Trachyandra*. Baker referred it to *Anthericum revolutum* L. but its stout succulent appearance on the plate indicates that it is better placed under *T. divaricata*.

23. *T. revoluta* (L.) Kunth, Enum. 4: 579 (1843).

*Anthericum revolutum* L., Sp. Pl. 310 (1753). Roem. & Schult., Syst. Veg. 7: 462 (1829). Adamson & Salter, Flora of the Cape Peninsula, 184 (1950). Type: no type preserved. Cape: Hermanus, *Galpin* 12898 (PRE, neo.). *A. filiforme*, (γ), Thunberg, Prod. 62 (1794) et in Fl. Cap. ed. Schult. 318 (1824). non Ait. Type: Cape, on hills below Table Mountain, *Thunberg*, sheet (γ) (UPS, holo., PRE, photo!). *A. elongatum* Willd., Sp. Pl. 2: 136 (1800); Roem & Schult. Syst. Veg. 7: 456 (1829); Bak. in Fl. Cap. 6: 389 (1897). Willdenow gave Thunberg's plant a new name as Aiton had already used the epithet *filiforme* for an *Anthericum* which is now *Bulbinella filiforme* (Ait.) Kunth. Sprengel in Syst. 2: 83 (1825) in error united them. *A. jacquinianum* sensu Bak. in J. Bot. Lond. 1872, 308, excl. var. et in Trans. Linn. Soc. 15: 308 (1876); *A. scabrum* sensu Duthie in Ann. Univ. Stell. 4, A: 15, 14 1926, non Lf.

?*Phalangium revolutum* Poir. in Encycl. Meth. Bot. 5: 247 (1804).

?*Dilanthes revolutum* Salisb. Fragm. 70 (1866).

*Trachyandra elongata* (Willd.) Kunth, Enum. 4: 584 (1843).



Adamson, Notes on Some Cape Peninsula Species of *Anthericum* in Journ. S.A. Bot. 7: 93 (1941).

Plants up to 50 cm high, usually smaller. *Roots* many, crowded, yellow, somewhat swollen, fusiform, firm, the circle of new roots produced above the old one. *Rhizome* small, discoid. *Squamae* narrow, tubular, reddish-brown, surrounding each leaf-base and also the scapes, separately (no squamae surrounding the shoots). *Leaves* erect or prostrate when older, sometimes slightly undulate or with a spiral twist, 10–40 cm long, 1–4 mm in diam. linear, firm and somewhat fleshy in texture, dark green, scabrid, at least when young, especially on the margins. *Inflorescence* a much branched, lax, pseudo-dichotomous, divaricate raceme, usually overtopping the leaves; scape slender, up to 30 cm long, 3–6 mm in diam., scabrid especially at the base when young; bracts small, 2–5 mm long; pedicels up to 1 cm, erect in bud and in fruit, recurved during anthesis. *Flowers* pendulous, perianth recurved forming a “ball” around pedicel, segments 8–10 mm long, narrow, white, brown-keeled and with 2 yellow maculae near the base; filaments yellow below, dimorphous, outer sparsely, inner densely shaggy in lower half, and curved around the ovary; ovary with ca. 10 ovules per cell. *Capsule* sub-globose, greyish brown, ca. 2 mm in diam., tetrahedral.

**FLOWERING PERIOD:** August to November. Odour heavy, musklike (*Duthie*). Adamson noted that it flowered freely after fires.

**DISTRIBUTION:** Eastern to western Cape, near the coast or more inland occasionally. “Common on seasonally damp, heathy flats”. Adamson. “Seasonal swamps” *Duthie*.

**CAPE.**—Cape Town: *Kuhl & van Hasselt* (L 909, 84/270), *Bolus* (BOL. 25734); Path above Kalk Bay, *Goulinis* (BOL. 25733); Wynberg: *Schlechter* 1546 (GRA); Rondebosch, *Bolus* 3750 (BOL); Noordhoek Flats, *Esterhuysen* (BOL, 25736); Sassar, *Bohnen* 1060 (PRE); Peninsula, Klaassenbosch, *Wolley* Dod 2454 (BOL). Stellenbosch: *Duthie* (BOL 25744). Hopefield: Saldanha Bay, Hoetjies Bay, *Bolus* (BOL. 12867). Ceres: Bokkeveld, *Marloth* 8364 (PRE). Van Rhynsdorp: Bitterfontein, *Schlechter* 11038 (GRA, L.). Namaqualand: near Soebatsfontein, *Verdoorn & Dyer* 1797 (PRE); foot of Kamies Mountains near Garies, *Esterhuysen* 1367 (BOL). Humansdorp: Kruisfontein, *Galpin* 4748 (PRE); Albertinia, *Muir* 1191 (BOL). Bathurst: Port Alfred, *Hutton* 1154 (GRA), *Rogers* 28052 (PRE). Port Elizabeth: *Paterson* 166 (GRA). Alexandria: *Archibald* 3686 (PRE). East London: *Galpin* 3357 (PRE).

It is the oldest known species from the Cape. Adamson in his helpful article (Journ. S.A. Bot. 7: 93, 1941), discusses the confusion that existed between *Anthericum revolutum* L. and *A. divaricatum* Jacq., while later on *A. flexifolium* sensu Jacq. (not of L.f.) also became involved. *A. divaricatum* Jacq. is a stout, glabrous bright green plant found on the dunes and flats near the sea. *A. revolutum* L. has a wider distribution and is usually found on firmer soils. It is more slender than *A. divaricatum* Jacq. and the base of the dark green leaves and scape are scabrid. The description of *A. revolutum* by Linnaeus although very short, does mention “*folia asperis*” which points to the slender plant.\* I therefore agree with Adamson that this smaller plant should be regarded as *A. revolutum* L. [*T. muricata* (L.f.) Kunth also possesses asperous leaves but it is not as common as *T. revoluta* (L.) Kunth].

In literature these two species were often confused. Miller, Thunberg and Baker seem to have thought that the two names were conspecific. Ker Gawler's plate in the Botanical Magazine, t.1044 (1807) also figures the more succulent *A. divaricatum* Jacq. In Thunberg's herbarium, *A. filiforme* γ is a synonym of *A. revolutum* L. As the epithet *filiforme* was invalid, Willdenow gave it a new name, *A. elongatum*. Roemer & Schultes then enumerated all 3 names in their Syst. Veg. 7: 456, 462 (1829). They also gave

\* “*Anthericum revolutum* L. was founded entirely upon a species described by Tournefort as *Asphodelus foliis compressus, asperis, caule patulo* and its country is unknown.” N. E. Brown on a sheet at J.



a new name, *A. jacquinianum*, to a plate (Ic. t.412) of an *Anthericum* which Jacquin had mistakenly called *A. flexifolium* L.f. When Baker revised the *Anthericum* species for the Flora Capensis he made this species, *A. jacquinianum*, a synonym of *A. elongatum* Willd. As neither the roots nor the squamæ of the species figured by Jacquin, correspond with those of *A. revolutum* L. (*A. elongatum* Willd. is a synonym), I do not think this was correct and have kept them separate.

23. *T. laxa* (N. E. Br.) Oberm., comb. nov., aggregate species.

*Anthericum laxum* N.E. Br. Kew Bull. 1909, 143.

Plants glabrous, up to 60 cm high. *Roots* many, somewhat fleshy or thin, often with a lanate pubescence of root hairs. *Rhizome* small, irregular, woody. *Squamæ* narrow tubular, membranous, brown, several surrounding each leaf- and scape-base separately but none surrounding a shoot. *Leaves* many, terete, up to 40 cm long, 3 mm in diam., erect or drooping, often glutinous from secretions of sub-epidermal glands situated in longitudinal lines. *Inflorescence* a divaricate much branched raceme, branches either alternate or the first three arising trichotomously from a clavate apex, the following branches alternate, laxly flowered; bracts ovate, ca. 3 mm long, membranous, white with a brown keel; pedicels up to 6 mm long, erect in bud, pendulous during anthesis, erect in fruit. *Flowers* pendulous with perianth 1 cm in diam. recurved from near the base, forming a "ball" around pedicel, white, dark keeled, with 2 yellow spots near the base, scentless, producing much nectar; 3 outer stamens scabrid, 3 inner forming a tube, curving outwards above ovary and there yellow and densely, retrorsely scabrid; the basal area touching the ovary, smooth with lateral, and dorsal fringes; ovary with ca. 10 ovules per cell. *Capsule* ca. 6 mm long, globose, dry. *Seed* dark brown, angled.

**FLOWERING PERIOD:** In late summer after rains, February to April. In South West Africa in the southern part the flowering period could be any time after a rare, rainy spell. The dry inflorescence starts rolling about in April.

**Common Names:** Rolbossie, tolbossie, sandui. Said to be eaten by animals, pigs even digging out the roots.

**DISTRIBUTION:** Kalahari sandveld; Bechuanaland, western Transvaal, western Free State, northern Cape, South West Africa.

#### KEY TO VARIETIES

Branches of inflorescence alternate; scape not clavate at the apex; plants rather slender (a) var. *laxa*  
Three lowest branches of inflorescence trichotomous; scape clavate at the apex; sturdy plants

(a) var. *laxa*.

(b) var. *erratica*

*Anthericum laxum* N. E. Br. in Kew Bull. 1909, 143. Type: Bechuanaland, Kalahari, Bachakuru, West of Serowe, *Lugard* 234 (K, holo. ! PRE, photo.).

*A. glutinosum* Dinter in Fedde, Rep. 16: 338 (1920); and in Fedde, Rep. App. 23: 55 (1923) name only. Type: South West Africa, Diamond Area 1: Klinghardt Mountains, *Schäfer* 559 (B, holo., probably destroyed). Dinter apparently overlooked his publication of the species in 1920 and republished it in 1931. Von Poellnitz now gave the second plant i.e. *Dinter* 3940, a new name i.e. *A. dinteri* Poelln. in Fedde, Rep 50: 232 (1942), nom. nov. for *A. glutinosum* Dinter in Fedde, Rep. 29: 265 (1931) non Dinter 1920. Type: South West Africa, Diamond Area 1: Buntfeldschuh, Namib, *Dinter* 3940 (B, holo. ! PRE, photo.). They are conspecific. *A. nigrobracteatum* Dinter in Fedde, Rep. 29: 265 (1931). Type: South West Africa: Diamond Area 1, Klinghardt Mountains, *Dinter* 3952 (B, holo. ! PRE, photo.). This plant was referred to under the name of *A. glutinosum* by Dinter in Fedde, Rep. App. 23: 55 (1923). It was collected in the same area as *A. dinteri* Poelln. and the differences are too small to merit the rank of a separate species. *A. buchubergense* Poelln. in Fedde, Rep. 52: 245 (1943). Type: South West Africa, Diamond Area 1, Buchu Mountains, *Dinter* 6571 p.p. (B, holo. ! PRE, photo.). ?*A. pachyrrhizum* Dinter in Fedde, Rep. 29: 157 (1923).

Type: South West Africa; locality uncertain, probably Diamond Area 1, Klinghardt Mountains in the S.W. Namib, *Dinter* 1780 (B, holo! PRE, photo.). The specimen is sterile but the roots and leaves are typical of *T. laxa*. ?*A. brunneoviride* Dinter ex Poelln. in Fedde, Rep. 52: 261 (1943). Type: South West Africa, Bethany: near Aus, *Dinter* 6202 (B, holo! PRE, photo.). The specimen is sterile but roots and leaves are typical of *T. laxa*. *A. elongatum* sensu Poelln. in Fedde, Rep. 52: 249 (1943). South West Africa, Bethany: Sandverhaar (near Aus), *Pearson* 4278, 4438 (BOL). The scape of one of the specimens was scabrid showing affinity to *T. revoluta*.

CAPE.—Prieska: *Bryant* B 338 (PRE). Kuruman: Batlharos, *Silk* 211 (PRE, SRGH), *Pole Evans* 2119 (PRE). Hay: Matsap, *Acocks* 2446 (KMG). Barkley West: *Acocks* 1557 (PRE, KMG). Kimberley: Koppies Kraal, *Muir* (PRE).

TRANSSVAAL.—Potgietersrus: Naboomspruit, *Galpin* 353 (PRE).

SOUTH WEST AFRICA.—Bethany: Sandverhaar, *Pearson*, 4278, 4438 (BOL).

(b) *var. erratica* (Oberm.) Oberm., stat. et comb. nov.

*Anthericum erraticum* Oberm. Journ. S.A. Bot. 2: 187 (1936). Type: Transvaal, Maquassi, *van Niekerk* (TM 35736, PRE, holo!). *A. arvense* Schinz var. *rigidum* Suess. in Mitt. Bot. Staatssam. Muenchen 1: 49 (1950). Type var.: South West Africa; Grootfontein, *Rehm* (M, holo!). Fig. 6, p. 000.

CAPE.—Barkley West, *Smith* 2332 (PRE). Kimberley: Doornfontein, *Adams* (PRE KMG, BOL). Hay: Padkloof, *Acocks* 2082 (PRE, KMG). Mafeking: *Brueckner* 570 (PRE). Vryburg: *Burt-Davy* (PRE, 14672).

ORANGE FREE STATE.—Boshof: near Boshof, *Schweickerdt* 1115 (PRE). Kroonstad: *Goossens* 1173 (PRE).

BECHUANALAND.—Genesa, *Rogers* (BOL, 12591). Mochudi, *Rogers* 6317 (BOL). Kanye, *Hillary & Robertson* 622 (PRE).

TRANSSVAAL.—Lichtenburg: Grasfontein, *Sutton* 380 (PRE). Potchefstroom, on road to Schoemansdrift, *de Wet* 1850 (PRE). Warmbaths: Radium, *Obermeyer* TM 35737 (PRE); near Pienaars River, *Codd* 848 (PRE).

SOUTH WEST AFRICA.—Gobabis: farm Onreg, *Merxmüller* 1117 (PRE, M); *Basson* 107 (PRE). Windhoek: *Meyer* (PRE). Otjiwarongo: Waterberg Plateau, *Boss* (PRE).

*T. revoluta* and *T. laxa* are two closely related tumble weeds; the first is a Cape species with rough, flat or rolled leaves and a scape that is pubescent at the base. *T. laxa* occurs in the Kalahari sandveld, is entirely glabrous and has terete, often glutinous leaves. It seems wisest to consider the umbellate species (*Anthericum erraticum*) a variety of *T. laxa* for these two forms occur side by side in some areas; but for the difference in the arrangement of the lowest branches of the inflorescence, they agree in other respects except that *T. erratica* is usually a somewhat stouter plant.

The herbarium material from South West Africa is very scanty. When more material becomes available and with more field work we will be able to judge better whether all Dinter's species are conspecific with *T. laxa*. In tumble weeds one can of course expect a wide and erratic distribution.

24. *T. arvensis* (Schinz) Oberm., comb. nov.

*Anthericum arvense* Schinz in Verh. Bot. Ver. Brand. 31: 216 (1889). Bak. in Fl. Trop. Afr. 7: 210 (1898). Poelln. in Fedde, Rep. 52: 245 (1943). Type: South West Africa: Ovamboland, Olukonda, *Schinz* (Z, holo! PRE, photo.). *A. flavoviride* Bak. in Fl. Trop. Afr. 7: 490 (1898). Type: Bechuanaland, Ngamiland, Botletle Valley, *Lugard*, 194 (K, holo.). *A. pallidiflavum* Engl. & Gilg in Warburg, Kunene Sambesi Exp. 187 (1903). Type: Angola (near S.W. border), Okavango Riverbank at Kavanga, *Baum* 412 (B, holo., probably destroyed). *A. gilvum* Krause in Engl. Bot. Jahrb. 48: 353 (1912). Poelln. in Fedde, Rep. 52: 249 (1943). Type: South West Africa:

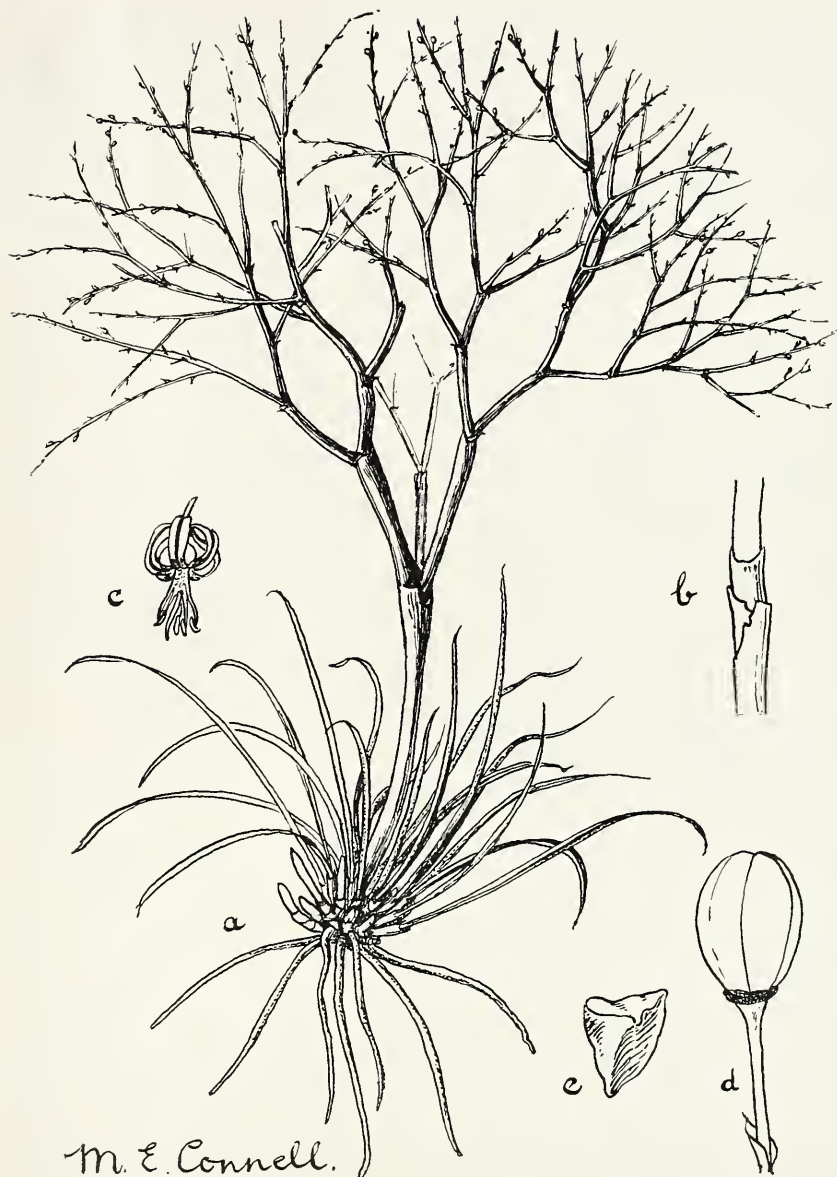


FIG. 6.—*Trachyandra laxa* var. *erratica* Oberm. a, habit,  $\times \frac{1}{4}$ . b, basal squamulae enveloping a leaf,  $\times 2$ . c, pendulous flower. d, capsule,  $\times 3$ . e, seed,  $\times 4$ .



Hereroland, Klein Namas near Hochanas *Dinter* 1941 (B, holo., probably destroyed); var. *brunneolum* Poelln. in Fedde, Rep. 52: 250 (1943). Type of var.: South West Africa, Hereroland, Otjispera near Epata *Seiner* III/357 (B, probably destroyed).

Slender, glaucous, glabrous plants up to 70 cm high. *Roots* many crowded, fusiform, dark brown. *Rhizome* woody, compact, globose, irregular. *Squamae* tubular, membranous, several enveloping each leaf- and scape-base, the outer gaping. *Leaves* linear, flat, or subterete, up to 60 cm long, 2.5 mm broad, glaucous, longitudinally grooved, long tapering to the apex. *Inflorescence* ca. 70 cm tall, a much branched divaricate, many flowered raceme; peduncle slender, ca. 40 cm long, 5 mm wide; side branches thin, lax, spreading; bracts minute, 2 mm long, white, membranous, acute; pedicels slender 2-3.5 cm long, recurved in flower, remaining so if flower is not fertilized, erect in fruit. *Flowers* with perianth pendulous, campanulate at the base, recurved, yellow, maculate; segments 1 cm long, 1 mm wide; stamens dimorphous the outer spreading, muricate, the inner connivent, curved outwards above the ovary with the filaments flattened below and these with lateral and dorsal fringes, densely covered with retrorse, obtuse papillae in upper half; ovary with 10-12 ovules per cell. *Capsule* erect, narrow ovate, 7 mm long, glabrous. *Seeds* smooth, often with an orange band (probably consisting of glands) near the hilum.

FLOWERING PERIOD: August-March.

DISTRIBUTION: Northern South West Africa, Bechuanaland, Southern Rhodesia, Northern Rhodesia, Angola.

Common on the sandy banks and islands of the Okavango River and its tributaries, also straying into surrounding country.

SOUTH WEST AFRICA.—Okavango Native Territory: between Runtu and Kapako, Okavango River, *de Winter* 3730 (PRE); Andara, *Merxmüller* 1962 (PRE, M). Grootfontein: Gautscha Pan, 157 miles E. of Grootfontein, *Story* 6150, 5321 (PRE).

SOUTHERN RHODESIA.—Salisbury: Hunyani River, in sand, *Wild* 4623 (SRGH); Arthur's Seat, Hunyani, *Greatrex* (SRGH, 13969).

NORTHERN RHODESIA.—Barotseland: Shangombo, Kwando or Mushi River, *Codd* 7469 (PRE); Nangweshi on the Zambesi River, *Codd* 7201 (PRE, SRGH).

25. *T. muricata* (L.f.) Kunth, Enum. 4: 576 (1843).

*Anthericum muricatum* L.f., Suppl. 202 (1781); Thunb., Prod. 63 (1794) et in Fl. Cap. edit. Schult. 322 (1823); Willd. Sp. Pl. ii: 145 (1799); Roem. et Schult., Syst. Veg. 7: 459 (1829); Bak. in Journ. Bot. Lond. 1872, 139 et in Fl. Cap. 6: 395 (1897); Adamson & Salter, Flora of the Cape Peninsula, 183 (1950). Type: Cape, *Thunberg* (UPS, holo., PRE, photo.). *Anthericum fimbriatum* Thunb., Prod. 63 (1794); Roem. & Schult., Syst. Veg. 7: 465 (1829) et in Fl. Cap. edit. Schult. 322 (1823). Type: Cape, *Thunberg* (UPS, holo., PRE, photo.). *A. bachmannii* O. Ktze, Rev. Gen. 3, 2: 315 (1898). Type: Cape, Malmesbury: Hopefield, *Bachmann* 802 (B, holo.! PRE, photo.). *A. scabromarginatum* Schlechter apud Poelln. in Bol. Soc. Brot. 16: 2. 80 (1942). Type: Cape, Calvinia: Doorn Rivier, *Schlechter* 10873 (B, holo.! GRA, PRE, iso.). *A. diphyllum* Dinter in Fedde, Rep. 16: 338 (1920); Poelln. in Fedde, Rep. 52: 248 (1943). Type: South West Africa, Diamond Area I: Klinghardt Mountains, *Schäfer* 553 (B, holo.! PRE, photo.). *A. apicicolum* Krause in Engl. Bot. Jahrb. 52: 236 (1921). Type: South West Africa: Klinghardt Mountains, *Schäfer* 553 (B, holo., probably destroyed). *Schäfer* 553 is the type for both *A. diphyllum* and *A. apicicolum*. *A. longifolium* sensu Sprengl., Syst. 11: 84 (1825). *A. longifolium* sensu Bak. in J. Bot. Lond. 1872, 139 et in Fl. Cap. 6: 394 (1897). *A. longifolium* sensu Duthie in Ann. Stell. Univ. 4, A: 9, t2, fig. 6, 9 (1926). Non Jacquin. Willdenow in Sp. Pl. II, 140 (1799), thought that *A. muricatum* L.f. and *A. longifolium* Jacq. could be conspecific and this was accepted as a fact by Sprengel, Baker & Duthie; cf. Adamson, Journ. S.A. Bot. 7: 99 (1941).

*Arthropodium muricatum* (L.f.) Sprengl., Syst. 2: 87 (1825).

*Trachyandra fimbriata* (Thunb.) Kunth, Ent m. 4: 583 (1843).



Few leaved, muricate or glabrous plants up to 50 cm high. *Roots* many, orange, thick, firm and long. *Rhizome* small. *Squamae* small, membranous, the outer loosely surrounding shoot, the inner closely surrounding leaf- and scape-bases. *Leaves* 2–10, opposite, flat, variable in size, linear to oblong, up to 80 cm long, 5–50 mm wide, muricated, especially along the raised margin and nerves, seldom glabrous. *Inflorescence* a laxly flowered, divaricate panicle up to 50 cm high, often with unequal accessory branches; scape firm, muricate or glabrous, nearly as long as the racemes; bracts small, 4 mm long, deltoid, auriculate; pedicels up to 12 mm in fruit, ascending. *Flowers* with spreading, maculate perianth, segments ca. 10 mm long; inner stamens connivent; ovary with 8 ovules per cell. *Capsule* globose, 5 mm in diam. glabrous. *Seeds* black, tetrahedral, with hyaline margins.

**FLOWERING PERIOD:** July–October. Adamson notes that it flowers most freely after fires.

**DISTRIBUTION:** Cape Peninsula, south western Cape to southern South West Africa; on mountain slopes.

**CAPE.**—Cape Town: Hills about Cape Town; *Prior* (PRE), Camps Bay, *Strey* 528 (PRE). Malmesbury: Riebeeck Kasteel Mountain, *Esterhuysen* 6029 (BOL). Stellenbosch: Guardian Peak, *Esterhuysen* 11997 (BOL); Jonkershoek, *Lam & Meeuse* 4406 (L.). Paarl: lower clay slopes of Seven Sisters, *Esterhuysen* 9047 (BOL). Clanwilliam: hills between Witte Els Kloof and Lamberts Hoek Berg, *Pillans* 9166 (BOL, PRE). Calvinia: Nieuwoudtville, *Schmidt* 225 (PRE).

**SOUTH WEST AFRICA.**—Diamond Area 1: Klinghardt Mts., *Schäfer* 553 (B).

The type of *A. scabromarginatum* from Doorn Rivier, Calvinia has numerous leaves which are short and glabrous. It may prove to be a separate species. As the species appears to be variable however, I have retained it here for the present.

26. *T. bulbinifolia* (Dinter) Oberm., comb. nov.

*Anthericum bulbinifolium* Dinter in Fedde, Rep. 29: 261 (1931). Type: South West Africa: Lüderitz Bay, *Dinter* 3836 (B, lecto.! PRE, photo.), 6693 (B, iso., probably destroyed); Rheinpfalz, *Dinter* 6387 (B, probably destroyed). *A. schlechteri* Poelln. in Fedde, Rep. 53: 130 (1944). Type: Cape, Namaqualand, Goechas, *Schlechter* 11376 (B, holo., PRE, GRA, iso.!). ?*A. odoratissimum* Dinter, in Fedde, Rep. 29: 260 (1931). Type: South West Africa, Diamond Area 1: coast at Rheinpfalz, *Dinter* 6377 (B, holo.! PRE, photo.); including var. *brevibracteatum* Dint.

Plants up to 40 cm high. *Roots* many, somewhat swollen near the rhizome, tapering to the tips, often felted. *Rhizome* compact, vertical. *Squamae* surrounding shoot forming a collar, outer firm, brownish, inner many, irregularly fimbriate, very thin, white, membranous. *Leaves* many, linear, up to 18 cm long, 5 mm wide, long tapered to the apex which is loosely curled when young, glabrous or minutely muricate or ciliate, apparently erect, glaucous. *Inflorescence* a divaricately branched raceme, laxly flowered; scape terete, slender, arcuate near the base, glabrous; bracts small, ovate, auriculate, mucronate, edges minutely ciliate; pedicels up to 15 mm long in fruit, erect. *Flowers* with a white, spreading, maculate perianth, segments 14 mm long; stamens uniform, filaments very shortly papillate, inner apparently connivent (no live flowers seen); ovary with 12 ovules per cell. *Capsule* oblong, rounded, 6 mm long. *Seeds* with sharp ridges.

**FLOWERING PERIOD:** May–November, probably after good rains.

**DISTRIBUTION:** South West Africa, north western Cape; known from the coastal sand near Lüderitz Bay to Port Nolloth, Steinkopf and Goechas in Namaqualand.

**SOUTH WEST AFRICA.**—Lüderitz: on road to Nautilus, *Kinges* 2597 (PRE); Lüderitz Bay 1 m S. of Lagoon, coarse sandy soil, mountainous country, *Giess & van Vuuren* 672 (PRE).

CAPE.—Namaqualand: sandy plain North of Ugrabis, *Marloth* 2666 (PRE); Steinkopf, *Marloth* 6753 (PRE); Port Nolloth, 26 miles East, *Theron* 1263 (PRE); Karroid hills 3 miles S. of the Orange River Mouth, *Pillans* 5608 (BOL); Kookfontein, *Bolus* 6604A (BOL).

*Anthericum odoratissimum* Dinter inhabits the same area as *T. bulbinifolia* and flowers at the same time. *Giess & van Vuuren* 867 from Aus may prove to be *A. odoratissimum* as the squamæ are large, membranous and gaping, not fimbriate, and therefore unlike those of *T. bulbinifolia*. But no other differences were detected. Here further observations in the field and more collections will be necessary to settle this problem.

27. *T. lanata* (Dinter) Oberm., comb. nov.

*Anthericum lanatum* Dinter in Fedde, Rep. 29: 261 (1931). Poelln. in Fedde, Rep. 52: 251 (1943). Dinter in Fedde, Rep. App. 23: 57 (1923) name only. Type: South West Africa: Diamond Area 1, Klinghardt Mountains, *Dinter* 3901 (B, holo.! PRE, iso.!). *A. sublanatum* Dinter in Fedde, Rep. 29: 262 (1931). Poellnitz in Fedde, Rep. 52: 25 (1943). Type: South West Africa, Lüderitz: Halenberg, *Dinter* 6628 (B, holo., PRE, photo.).

Small plants up to 30 cm. *Roots* many, felted, up to 22 cm long. *Squamæ* membranous, many, loosely arranged; outer squamæ apparently absent or small. *Leaves* many, linear, up to 25 cm long, 2 mm wide, tortuous, lanate with long, soft, retrorse hairs. *Inflorescence* longer than the leaves, umbellate, with about 9 branches arising out of the apex of the scape, secondary branches with unequal accessory branches, many flowered; scape lanate or glabrous, firm, up to 14 cm long, about as long as the umbel; bracts small, membranous, apiculate, auriculate; pedicels up to 8 mm in fruit, erect, thin. *Flowers* with perianth white, brown-keeled, maculate, segments 6 mm long; filaments shortly papillate, uniform, inner erect, connivent! (no live flower seen); ovary with ca. 10 ovules per cell. *Capsule* globose, black, 5 mm in diam. *Seeds* (unripe) with hyaline ridges.

FLOWERING PERIOD: August–September.

DISTRIBUTION: South West Africa, Namib

SOUTH WEST AFRICA.—Diamond Area 1: Pomona, S. of Lüderitz Bay, *Schaefer* in herb. *Marloth* 6597 (PRE).

The differences mentioned between *T. lanata* and *A. sublanatum* by Dinter, are not important.

28. *T. thyrsioidea* (Bak.) Oberm., comb. nov.

*Anthericum thyrsioides* Bak. in J. Bot. Lond. 1872, 139; Fl. Cap. 6: 393 (1897). Type: Cape, Tulbagh, Yuk River Hoogte, *Burchell* 1231 (K, holo.).

Small plants up to 18 cm long, hirsute. *Roots* many, somewhat swollen but not bulbous. *Rhizome* small. *Squamæ* membranous, broadly oblong, loosely arranged around the shoots, leaf- and scape-bases. *Leaves* many, linear, up to 16 cm long, 2 mm broad, tapering gradually to the apex, covered with long, tawny, retrorse hairs. *Inflorescence* a many flowered, fairly compact raceme, in some plants sub-umbellate at the base; scape short, firm, ca. 7 cm long, setose with tawny, retrorse hairs; bracts conspicuous, white, membranous, deltoid, cuspidate, margin irregularly dentate; pedicels filiform, hirsute, firm in fruit up to 8 mm, about as long as the bracts. *Flowers* with a mauve or pink, maculate perianth (maculae near the middle of segment), segments 8 mm, spreading (or recurved?); filaments shortly papillate, inner connivent? (no live flower seen); ovary with 10 ovules per cell. *Capsule* globose, 5 mm in diam. glabrous. *Seeds* not seen.

FLOWERING PERIOD: August.

DISTRIBUTION: Cape: originally collected by *Burchell* in the Tulbagh district; recently found in the White Hill Karroo Garden.

CAPE.—Laingsburg: White Hill Ridge, *Compton* 3228, 13397 (NBG); Matjiesfontein, *Beattie* (NBG 2562/14, BOL).

29. *T. tortilis* (Bak.) Oberm., comb. nov.

*Anthericum tortile* Bak. in Bull. Herb. Boiss. Ser. 2, 4: 996 (1904). Type: Cape: Tulbagh, Saron, *Schlechter* 4846 (Z, holo.! PRE, photo.). *A. salteri* Leighton in Flow. Pl. of A. 18; t. 687 (1938). Type: Cape: Namaqualand, Springbok, *Salter* 966 (BOL, holo.). *A. oocarpum* Schlechter ex Poelln. in Bol. Soc. Brot. 16, 2: 75 (1942). Type: Cape, Namaqualand, Zuurfontein, *Schlechter* 8525 (B, holo.! PRE, photo.).

Small plants up to 15 cm. *Roots* fused into a few long tubers and with some straggling thin, branched rootlets at the apex and tips. *Rhizome* small. *Squamae* membranous, broad surrounding shoot, leaf- and scape-base. *Leaves* 3–6, linear, up to 10 cm long, 6 mm broad, flat, long tapering to the apex, transversely, plicately folded, glabrous or minutely pubescent, glaucous, margin prominent. *Inflorescence* a divaricate panicle overtopping the leaves, side branches short 1–5; scape arcuate at the base, firm; bracts broad, auriculate, apiculate, membranous, shorter than the pedicels; pedicels up to 5 mm, recurved in fruit. *Flowers* with pale pink, maculate, spreading perianth segments, 1 cm long; filaments scabrous above, fimbriate below, declinate; ovary with 10 ovules per cell. *Capsule* narrow ovoid, 7 mm long. *Seeds* ridged.

FLOWERING PERIOD: June–August. Flowers scented.

DISTRIBUTION: Cape, South-western districts, Namaqualand, Vanrhynsdorp-Tulbagh and Hopefield.

CXPE.—Namaqualand: Mesklip, *Esterhuysen* 5953 (PRE, BOL). Vanrhynsdorp: Nieuwerust, *Esterhuysen* 5982 (BOL). Hopefield: *Bolus* 12871A (NH).

The leaves of this species are most unusual. They are folded in a compressed, transversely plicate manner like a concertina.

30. *T. jacquiniana* (Roem. & Schult.) Oberm., comb. nov.

*Anthericum jacquinianum* Roem. & Schult. Syst. Veg. 7: 462 (1829) nom. nov. for *A. flexifolium* sensu Jacq. Ic. 2, t.412 (1786–1793); non L.f. Type: Iconotype, Cape, Jacquin, Ic. 2, 18; t.412. *A. elongatum* Willd. var. c, *flexifolium* sensu Bak. in Fl. Cap. 6: 389 (1897).

*T. jacquini* Kunth, Enum. 4: 578 (1843).

Plants up to 50 cm high. *Roots* 1–7, bulbous, separate or fused above, becoming hard with age, often covered with many, thin, hard skins. *Rhizome* small, woody. *Squamae* large, membranous, surrounding shoot, leaf- and scape-base. *Leaves* ca. 12 per shoot, filiform or linear, flat, up to 15 cm long, 2 mm broad, wavy when young, later erect, straight, with lax, long, patent silky hairs, dull blue-green. *Inflorescence* a divaricate panicle with many short, accessory branches in the axils of the main branches, many flowered; scape terete, firm, straight, laxly silky haired below, glabrous with age; bracts short, auriculate, apiculate, membranous; pedicels short, 5 mm in fruit, erect; if flower is not fertilized the short pedicel recurves; buds sessile. *Flowers* with recurved, maculate perianth, segments 11 mm long; filaments erect, inner connivent, hirsute below, muricate above; ovary with 12–16 ovules per cell. *Capsule* oblong or, if few ovules are fertilized, obovoid. *Seeds* with ridges.

FLOWERING PERIOD: June–September. Sweet smelling. “Anysblom” (*Marloth*). “Flores odoratissimi, aemuli heliotropio peruviano” (*Jacquin*).

DISTRIBUTION: Western Cape; Laingsburg, Carnarvon, Williston, Clanwilliam, Calvinia, Namaqualand.



CAPE.—Laingsburg: near Ketting Station, *Acocks* 17136 (PRE). Williston: *Acocks* 14700 (PRE). Carnarvon: 3 m. S. of Carnarvon, *Acocks* 16426 (PRE). Clanwilliam: near Doorn Rivier, *Lewis* (SAM 64668, NBG); Agtertuin, *Schlechter* 10865 (BOL, PRE). Clanwilliam: *Esterhuysen* 5536 (BOL, PRE). Calvinia: Driefontein, Voor Hantam, *Marloth* 1280 (PRE); near Lokenburg, *Acocks* 18485 (PRE). Namaqualand: Brakdam, *Esterhuysen* 5688 (PRE); Bowesdorp, *Lewis* (SAM 55873, NBG); Garies, *Acocks* 16436 (PRE).

Although no type is preserved, the specimens cited agree with the Jacquin plate. They show the short, erect pedicel, the leaf has a lax pubescence of long silky patent hairs, the root is tuberous and the outer squamæ form a collar around the base of the shoot.

The following specimen differs somewhat from typical *T. jacquiniana*; *Acocks* 19290 from near Van Rhynsdorp, succulent Karroo of hummocky flats, "rare" (PRE). The leaves are rather short, wavy, terete, striate, tapered at the apex, forming a neat flat rosette raised off the ground. This plant is glabrous and has the leaves spreading instead of erect.

31. *T. paniculata* Oberm., sp. nov. *T. muricatae* affinis, sed radicibus bulbosis, foliis hirsutis differt.

*Radices* tuberosae sed non inter se adnatae. *Folia* circ. 4, lanceolata pubescentia saepe undulata. *Racemus* multiflorus, ramis multis patentibus secundariis ferens; pedicelli erecto-patentes ca. 1 cm longi. *Flores* albi maculati; ovula in loculis 10. *Capsula* parva globosa.

Plants up to 30 cm high. *Roots* many, short, bulbous. *Rhizome* small. *Squamæ* thin, loose, membranous. *Leaves* 3–4, linear-lanceolate, up to 20 cm long, 1 cm broad, flat, straight or wavy, glabrous above, pubescent below, margin slightly raised, sparsely fimbriate, tapered to the apex. *Inflorescence* a divaricate raceme with accessory branches in many of the axils, many flowered, overtopping the leaves; scape with a slight curve, about as long as the panicle, pubescent below; bracts small, ovate, apiculate, auriculate; pedicels erecto-patent, ca. 1 cm long in fruit. *Flowers* with a white, maculate perianth, segments 8 mm long; filaments papillate; ovary with 10 ovules per cell. *Capsule* globose ca. 4 mm in diam. *Seeds* not seen.

FLOWERING PERIOD: September–October.

DISTRIBUTION: Only known from the Clanwilliam district in the south western Cape.

CAPE.—Clanwilliam: Olifants River, Rondegat, *Schlechter* 10792 (PRE, holo., L, iso.). Pakhuis, *MacOwan* 1985 (NBG); east side of the Olifants River Valley in shady fissures in sandstone rocks, *Diels* 366 pro parte (B).

The species resembles *T. muricata* but the roots are few, tuberous and short. It differs from *T. tortilis* in that the roottubers are not fused, the leaves pubescent, the raceme much branched and the pedicels erect in fruit. The leaves may show some transverse folds when young.

32. *T. zebrina* (*Schlecht. ex Poelln.*) Oberm., comb. nov.

*Anthericum zebrinum* Schlechter ex Poelln. in Bol. Soc. Brot. 16, 2: 66 (1942). Type: Cape, Namaqualand, Brakdam, *Schlechter* 11128 (B, holo. PRE, GRA, L, iso.), Fig. 7.

Plants up to 20 cm high. *Roots* many, some short and bulbous, others longer and thinner, with swellings near the tips. *Rhizome* small. *Squamæ* membranous, long, tubular forming a neck around shoot, often up to 4 cm long, usually transversely striped with dark brown lines; apex horizontal, irregularly toothed. *Leaves* about 4 per shoot, filiform to linear, ca. 18 cm long (occasionally up to 45 cm), 1–5 mm broad, wiry, glossy, bright green, straight or wavy when young, shortly pubescent or glabrous. *Inflorescence* a branched, many flowered raceme, side branches ascending, very short in young plants; scape terete, pubescent; side branches and pedicels with



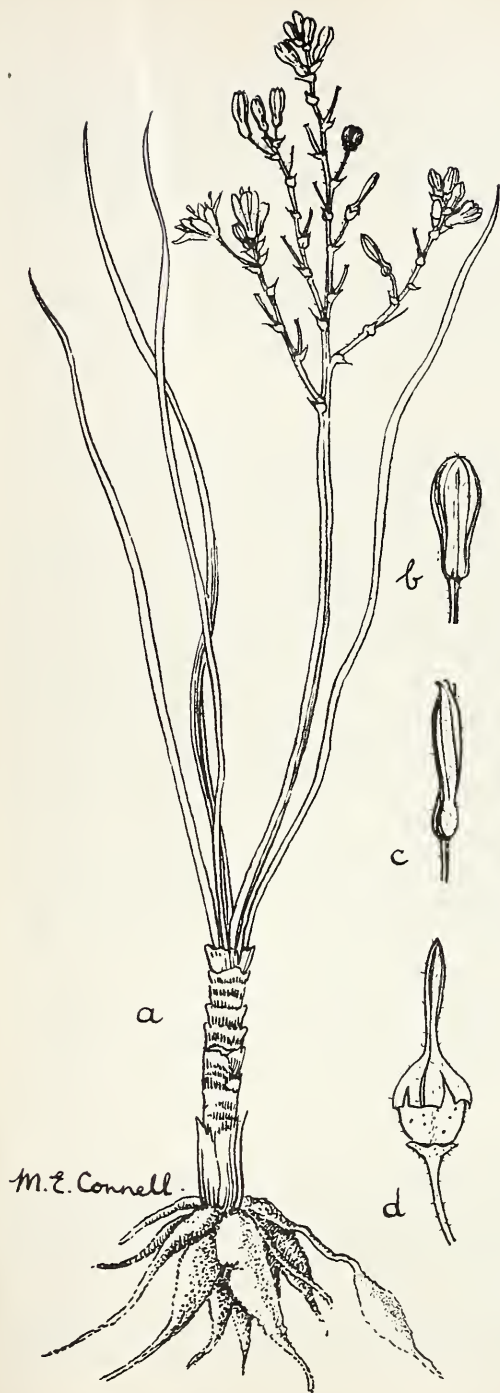


FIG. 7.—*Trachyandra zebrina* (Schltr. ex Poelln.) Oberm. a, habit. b, young bud,  $\times 2$ . c, closed flower,  $\times 2$ . d, young fruit,  $\times 2$ .

short, hard, patent bristles; bracts ovate, apiculate or subulate, auriculate, white, membranous, ciliate; pedicels patent-ascending, bristly, up to 8 mm long. *Flowers* with a white or pinkish-mauve perianth with brown keels and maculae, hispid on the outside, segments ca. 9 mm long; filaments with short papillae; ovary with 8 ovules per cell, glabrous when young, becoming hispid with sparse, short, reflexed hairs when capsule develops. *Capsule* globose, hispid. *Seeds* not seen.

FLOWERING PERIOD: July–November.

DISTRIBUTION: South-western Cape; known only from Namaqualand.

CAPE.—Namaqualand: near Garies, *Acocks* 19314 (PRE), *Theron* 1265 (PRE); Karrachas Pass, between Springbok and Kubus, *Verdoorn* 1823 (PRE); Brackdam, *Esterhuysen* 5678 A (BOL, PRE).

Typical of this species are the usually striped squamae and the hispid raceme and capsule.

33. *T. karrooica* Oberm., sp. nov., distincta, nullis e specibus notibus propinqua.

*Plantae* parvae ad 15 cm altae. *Radices* tuberosa, superne inter se adnatae. *Folia* filiformia. *Racemus* ramis patentibus 1–3 ramo principali aequilongis, scapo brevi, pedicellis patentibus 2–5 cm longis. *Flores* maculati; ovula in loculis 6.

Plants up to 15 cm high. *Roots* fused above with rhizome, split below into 2–3 tubers or entire, soft when young, becoming hard and brown skinned when old. *Rhizome* small. *Squamae* small, thin, transparent, white, membranous. *Leaves* about 7 per shoot, filiform, 7–15 cm long, 1 mm broad, glabrous or with a few silky hairs, apex apiculate. *Inflorescence* with 1–3 spreading branches nearly as long as the main branch, about as long as the leaves; scape short, up to 5 cm, shortly pubescent; rachis glabrous; bracts small subulate; pedicels patent up to 2.5 cm long, apex occasionally somewhat recurved in fruit. *Flowers* with a white perianth, maculate with yellow spots, segments 8 mm long; filaments retrorsely papillate; ovary with 6 ovules per cell. *Capsule* globose, 4 mm. *Seeds* (immature) with hyaline ridges.

FLOWERING PERIOD: February–March. There is one record of it flowering in October (*Bolus* 13830 from Richmond). Bryant noted that the flowering season was short. At Vogelstruisbult in the Prieska district, he found it to be fairly common but he could not find more than 3 specimens in flower.

DISTRIBUTION: Apparently a rare, short flowering Karroo species collected only once in each of the following districts, Calvinia, Richmond, Prieska and Kimberley. *Merxmüller* 1719, from South West Africa, Namib, 35 miles East of Henties Bay, also seems to belong here.

CAPE.—Richmond: False Karroo, 17 m west of Richmond, *Acocks* 16341 (PRE, holo.!). Vlakplaats, *Bolus* 13830 (BOL). Calvinia 56 m. west of Fraserburg (locally abundant) *Acocks* 14153 (PRE). Prieska: Vogelstruisbult, *Bryant*, J.256 (PRE). Kimberley: Mauritsfontein, *Acocks* 5759 (KMG, with a very young inflorescence). SOUTH WEST AFRICA.—Omaruru: 35 m east of Henties Bay, *Merxmüller* 1714 (M, PRE).

34. *T. patens* Oberm., sp. nov. *T. flexifoliae* affinis sed pedicellis longioribus patentibus differt, etc.

*Plantae* ad 40 cm altae. *Radices* lanatae tuberosae, superne inter se adnatae. *Squamae* firmatae brunneae collum longum formantes, interiores pallidae membranaceae. *Folia* filiformia terna surculo, juvenia spiralia. *Racemus* divaricatus patens globosus multiflorus ramis multis secundariis ferens; pedicelli patentes ca. 1 cm longi. *Flores* maculati; filamenta biformia; ovula in loculis 10. *Capsula* globosa. *Semina* verrucosa.

Plants up to 40 cm high. *Roots* forming one tuber in young plants increasing to many separate tubers with age, often narrowed above where attached to rhizome,

with numerous straggling, lanate rootlets. *Rhizome* small. Older plants producing 4-7 shoots. *Squamae*, the outer firm, brown, forming a long, narrow neck around shoot; inner thin, pale membranous. *Leaves* about 3 per shoot, filiform, up to 35 cm long,  $\frac{1}{2}$ -1 mm broad, erect, straight or wavy (especially so when young when the upper half forms a corkscrew curl), sparsely pubescent or glabrous. *Inflorescence* a patent, divaricate, many flowered raceme with accessory branches in many of the axils; at first overtopping the young leaves, later, when the latter are full grown, more or less equal in length; scape up to 24 cm long, minutely pubescent below; bracts small, ovate, apiculate, membranous, white; pedicels patent or patent-ascending up to 1 cm long. *Flowers* with brown keeled, maculate perianth segments up to 1 cm long; filaments white, scabrous, the 3 inner bearded at the base, yellow in lower half (*vide Marloth*); ovary with 10 ovules per cell. *Capsule* globose, 3 mm. *Seeds* verrucose.

FLOWERING PERIOD: August-November. Sweet scented ("like a Rève d'or rose," *Marloth*).

DISTRIBUTION: Western Cape, apparently abundant in Namaqualand, also collected at Piketberg, possibly also Sutherland and Swellendam districts.

CAPE.—Piketberg: Boschkloof, *Leighton* 114 (BOL); Plateau on Kapiteins Kloof Mountain, *Pillans* 8016 (BOL), *Stokoe* 8512 (BOL); stony slopes on Twentyfour River Mts. above Porterville, *Esterhuysen* 16196 (BOL). Namaqualand: *Scully* 104 (PRE, holo.!, BOL, iso!); between Khamieskroon and Springbok, *Pillans* 6351, 6355 (BOL); Mesklip, *Esterhuysen* 5831, 5832, 5847 (BOL), *Leighton* 1367 (BOL); Goechas near Steinkopf, *Schlechter* 11373 (BOL); Kookfontein, *Bolus* 6605 (BOL, NBG).

Recognized by its rounded divaricate, many flowered raceme with many accessory branches and the pedicels which are patent and arranged fairly close together at short, regular intervals.

A specimen, *Bolus* in herb. BOL, 19605, from Nieuwoudtville, Calvinia district, has a nearly simple raceme. This may have been the result of an injury which prevented the side branches from developing normally. As a result the apical growth is stimulated to form more flowers than usual. An analogous development was noted in *T. affinis* Kunth.

The following specimens collected more to the East, Sutherland: Klein Roggeveld, *Marloth* 10399 (PRE); foot of Komsberg Pass, *Leistner* 268 (PRE); Swellendam, *Marloth* 8608 (PRE), seem to be near *T. patens* but the racemes are simple or with 1-2 short, basal branches. The root tubers formed purple stains on the sheets around the area where they were mounted. They were poisoned with mercury-chloride and the combination of this and a chemical in the tubers must have caused the colour patches.

### 35. *T. oligotricha* (Bak.) Oberm., comb. nov.

*Anthericum oligotrichum* Bak. in Bull. Herb. Boiss. Ser. 2, 4: 996 (1904). Type: Cape, Piketberg, *Schlechter* 4857 (Z, holo., GRA, PRE, iso!). The number was erroneously published as 4887. *A. filiforme*  $\delta$  Thunberg, nom. tant. ex Juel, Pl. Thunb. 120 (1918). Cape Thunberg (UPS, holo. PRE, photo.). *A. elongatum* sensu Duthie in Ann. Stell. Univ. 4, A: 11, t.III (1926); non Willd.

Plants up to 30 cm long. *Roots* swollen, pale, short, covered with old skin flakes with many straggling rootlets, spreading horizontally. *Rhizome* short, vertical. *Squamae* surrounding shoot yellow or white. *Leaves* usually about 7, erect, filiform, ca. 15 cm long, 1 mm in diam., soft, usually with some reflexed bristlelike hairs occasionally glabrous, rarely densely hairy. *Inflorescence* usually overtopping the leaves, up to 30 cm high, simple or with a few, short, ascending branches, few flowered; scape slender, glabrous or minutely scabrid; bracts small, ovate, auriculate, ending in a long, soft awn, membranous; pedicels short, ascending, up to 6 mm in fruit, buds sessile. *Flowers* with a spreading perianth, white or pale pink, brown keeled, maculate with yellow dots near the base; segments about 10 mm long, filaments subequal,



muricated, flattened below and there with dorsal and lateral fringes; ovary with 10 ovules per cell. *Capsule* oblong, apiculate, 3–6 mm long, touching rhachis. *Seeds* tetrahedral, dark brown, verrucose.

FLOWERING PERIOD: July–November, “Odour heavy, musklike” (Duthie).

DISTRIBUTION: Cape, confined to a few south western districts, Piketberg, Ceres, Stellenbosch, Cape. “In clay soil, rare in sand” (Duthie).

Duthie notes that it is the most abundant species around Stellenbosch. In favourable conditions the plants are closely crowded, the horizontal roots interlacing in a striking manner. Vegetative reproduction by means of root-buds is worth noting. The pubescence is variable. Duthie found juvenile plants to be glabrous. One plant of *Schlechter* 10712 (L) was found to be densely hispid.

CAPE.—Cape Town: Phesantekraal, *van Niekerk* 160 (PRE). Stellenbosch: *Duthie* 522 (J. 15617, J. STE); Faure, *Strey* 523 (PRE). Piketberg: Kapitein's Kloof Mountain, *Pillans* 8016 (BOL); Boschkloof, *Leighton* 114 (BOL); Piketberg Road, *Schlechter* 10712 (L.) (PRE). Ceres: Ceres Road, *Schlechter* 8982 (PRE, L.).

36. *T. flexifolia* (L.f.) Kunth, Enum. 4: 579 (1843).

*Anthericum flexifolium* L.f., Suppl. 201 (1781). Thunb. Prod. 62 (1794) et in Fl. Cap. edit. Schult. 318 (1823). Roem. & Schult. in Syst. Veg. 7: 461 (1829). Bak. in J. Linn. Soc. 15: 307 (1876). Type: Cape, *Thunberg* (LINN, holo., UPS, iso. PRE, photo.). *A. serpentinum* Bak. in Flor. Cap. 6: 387 (1897). Adamson & Salter, Flora of the Cape Peninsula 1950; 180. Type: Cape, Riet Valley near Cape Town, *Ecklon & Zeyher* (K, syn.! PRE photo.). Malmesbury, *Bachmann* 870 (K, syn.). *A. cirrifolius* Schinz, in Bull. Herb. Boiss. Ser. 2, 2: 937 (1902). Type: Cape: Piketberg, Piquenierskloof, *Schlechter* 4921 (Z, holo.! PRE, GRA, BOL, NBG, iso.!). *A. pappei* Bak. in Flor. Cap. 6: 388 (1897); Duthie in Ann. Stell. Univ. 4, A: 13 t.I, fig. 6, 8 (1926). Type: Cape, Tulbagh, *Pappe* (K, holo.! PRE, photo.).

Plants up to 25 cm high, rarely up to 60 cm. *Roots* tuberous short, about 4–8, not fused, spreading, with some straggling rootlets, sometimes covered with old skin flakes. *Squamae* surrounding the shoot short, membranous, dirty white. *Leaves* variable, 5–12 per shoot, straight or wavy, filiform, 7–30 cm long, about 1 mm in diam. (seldom flat and up to 5 mm wide), wiry, bright green, glossy, striate, with a minute rough pubescence or glabrous, sometimes with some white bristles near the base on the lower surface. *Inflorescence* an ascending panicle with 2 to many branches, as long as the leaves or overtopping them; flowers fairly close together, more lax in the taller forms; peduncles slender, straight, minutely scabrid or glabrous; bracts small, deltoid, cuspidate or aristate; pedicels short, erect, up to 8 mm in fruit, buds sessile. *Flowers* with a white, dark-keeled perianth, maculate with yellow spots, segments 1 cm long; filaments dimorphous, outer stamens scabrid, inner forming a tube, conspicuously muricated above, flattened and fringed below; ovary with 6–10 ovules per cell. *Capsule* globose, 5 mm in diam., glabrous, touching rhachis or ascending. *Seeds* black.

FLOWERING PERIOD: July–October.

DISTRIBUTION: The typical, small form is found on or near the Cape Peninsula, the larger form (*Anthericum pappei* Bak.) is found around Tulbagh and further north to Namaqualand. The *A. cirrifolius* Schlechter form with wider leaves, is from the Piketberg and Clanwilliam districts.

CAPE.—Cape Town: lower slopes of Devil's Peak near Blockhouse, *Leighton* 2062 (BOL); Lion's Head near Camps Bay, *Wolley Dod* 2331 (BOL); near Melkbosch Strand, *Esterhuysen* 2841 (BOL). Malmesbury: Riebeeck Kasteel Mt. near Botmanskloof, *Esterhuysen* 6028 (BOL, PRE). Tulbagh: Tulbagh, *Esterhuysen* 17405 (BOL), *Duthie* (BOL. 25716). Ceres: slopes below old Witzenberg Pass, *Esterhuysen* 20663 (BOL). Clanwilliam: Olifants River Barrage, *Esterhuysen* 5375 (BOL, PRE), 5802 (BOL); The Rest near Grey's Pass, *Gillett* 3714 (BOL); N. of Pakhuis, *Esterhuysen*



25715 (BOL). Vanrhynsdorp: Giftberg, *Esterhuysen* 21976 (BOL); Klaver, *Andreae* 443 (PRE); Attys, *Schlechter* 8327 (BOL, L). Namaqualand: near Springbok, *Acocks* 19331 (PRE).

Duthie who studied the species at Stellenbosch and at Tulbagh, noted their variability in size and amount of branching in the inflorescence and suspected that she was dealing with one variable species (cf. Ann. Stell. Univ. 4, A: 14, 1926). Dr. C. G. Alm of Uppsala kindly compared a specimen, *Leighton* 2062, from Devils Peak, Cape Town, with the type of *Anthericum flexifolium* L.f. in the Thunberg Herbarium and found them to be identical. This specimen also agreed closely with the type of *A. serpentinum* Bak. preserved at Kew. This typical form, found around Cape Town and Stellenbosch, is a small form; apparently the climate does not suit it. The more luxuriant forms are found around Tulbagh; they are taller with the much branched inflorescence overtopping the leaves which moreover are often nearly straight. They agree with *A. pappei* Bak. which must also be regarded as a synonym. The type of *A. cirrifolius* Schinz from Piquenierskloof, has flat wavy leaves, up to 8 mm in width but one plant from the type collection, on the BOL sheet shows the typical, narrow *T. flexifolia* leaf. It can also be considered a synonym of *T. flexifolia*.

37. *T. dissecta* Oberm., sp. nov., distinctissima, nullis e specibus notibus propinqua.

*Plantae* parvae glabrae ad 30 cm altae. *Radices* inter se adnatae tuberosae durae. *Squamae* collum durum brunneum formantes, interiores membranaceae dissectae. *Folia* 1–4 filiformia. *Racemus* floribus paucis ramosus; pedicelli breves tenues in fructu ad 5 mm; ovula in loculis 10. *Capsula* erecta rhachidi attingens.

Plants small, up to 30 cm high, glabrous. *Roots* short, hard, few, tuberous, rough in old plants where the outer skins flake off. *Rhizome* small. *Squamae* up to 3 cm long, forming a neck, outer hard, brown, inner membranous, split into shreds. *Leaves* 1–4, filiform, 6–16 cm long, wiry, erect or curved outwards, bright green, glossy. *Inflorescence* a divaricate, few flowered panicle with about 3 branches; scape thin, terete, about as long as the leaves or slightly shorter; bracts minute, black or colourless, apiculate; pedicels short, thin, up to 5 mm in fruit, erect. *Flowers* with a white, brown keeled, maculate perianth, segments 8 mm long, spreading or somewhat recurved; filaments subequal, inner surrounding the ovary at the base; ovary with 10 ovules per cell. *Capsule* oblong, 5 mm long, touching rhachis. *Seeds* (unripe) small, with hyaline ridges.

FLOWERING PERIOD: August–October.

DISTRIBUTION: Cape, Ceres, Calvinia, Vanrhynsdorp and Namaqualand districts; apparently found in stony, karroid surroundings.

CAPE.—Ceres: Bokkeveld Karroo, Paardekop near Spes Bona, Dwyka Rocks, *Marloth* 12531 (PRE, holo.); Ceres Karroo, Zwartkoppies near Spes Bona, *Marloth* 10471 (PRE). Calvinia: 53 m. S. of Calvinia, stony succulent karroo (locally fairly frequent), *Acocks* 18989 (PRE). Carnarvon: Karee desert, Klipkolk, *Stephens* 6518 (BOL). Vanrhynsdorp: Salt River, *Stokoe* 8509 (BOL).

Section 3. GLANDULIFERA Oberm., nov. sect.

*Radices* tenues longae, acumen versus anguste fusiformia. *Folia* uniformia; basi saepe reliquis fibrosis. *Racemi* ramosi rarius ad racemum simplicem redacti, leviter vel dense glandulosi. *Capsula* tuberculis glanduliferis. *Semina* verrucosa.

38. *T. scabra* (L.f.) Kunth, Enum. 4: 585 (1823).

*Anthericum scabrum* L.f. Suppl. 202 (1781). Thunb. Prod. 63 (1794) et in Fl. Cap. ed. Schult. 320 (1823); Bak. in J. Bot. Lond. 1872, 137, in J. Linn. Soc. 15: 310 (1876), and in Fl. Cap. 6: 392 (1897). Type: Cape, sandy plains between Cape Town and Hottentotsholland, *Thunberg* (UPS, sheet 2, holo., PRE, photo.).

*Bulbine scabra* (L.f.) Roem. & Schult. Syst. Veg. 7: 451 (1829). Fig. 8.



FIG. 8.—*Trachyandra scabra* (L.f.) Kunth. a, habit,  $\times \frac{1}{2}$ . b, flower,  $\times 7$ . c, capsule,  $\times 4$ . d, stamen,  $\times 10$ . e, tubercle tipped with a stipitate gland, enlarged.

Slender plants up to 40 cm high. *Roots* thin, wiry. *Stem* woody, branched near the base into about 5 very short, woody contracted shoots, which are densely covered with the congested tubular, membranous leaf-bases. *Leaves* many per shoot, lamina contracted above the base, linear, up to 40 cm long, 2 mm broad, triquetrous, somewhat leathery, muciculate or glabrous. *Inflorescence* an elongated, simple or few-branched, glandular-scabrid raceme; flowers laxly arranged; scape muricate, the scabrid points gland-tipped when young; bracts small, deltoid, apiculate; pedicels up to 2 cm long, patent with the apex recurved in fruit. *Flowers* with a maculate perianth, segments 7 mm long; filaments with long retrorse bristles; ovary glandular, with 2 ovules per cell. *Capsule* obtriangular, trisulcate, stipitate, 5 mm long, the apical tubercles larger; persistent perianth-cup forming a frill at the base. *Seeds* usually 2 per loculus, ovoid, 5 mm in diam., grey, flattened, coarsely verrucose and with hard ridges.

FLOWERING PERIOD: September–December.

DISTRIBUTION: South Western Cape, on sand dunes near the coast. Apparently absent on the Cape Peninsula, where the closely related *T. sabulosa* takes its place.

CAPE.—Wynberg: Cape Flats near Stickland Siding, *Acocks* (BOL 24270). Malmesbury: near Darling, *Esterhuysen* 3877 (PRE), *Bolus* 12869 (BOL). Hopefield: near Hopefield, *Leighton* 2446 (BOL); near Vredenburg in sand between Hoetjies Bay and Saldanha Bay, *Bolus* (BOL 12868). Clanwilliam: Olifants River Valley, Keerom, sandy hills, *Esterhuysen* 17857 (BOL); Pakhuis, *Esterhuysen* 3195 (BOL); Lange Vallei, *Leighton* (BOL 21618); Nortier Reserve, Lamberts Bay, *Acocks* 15191 (PRE). Vanrhynsdorp: Klaver, *Bolus* (BOL 20652).

39. *T. sabulosa* (*Adamson*) *Oberm.*, comb. nov.

*Anthericum sabulosum* Adamson in Journ. S.A. Bot. 1941, 99. Type: Cape, Cape Town, Retreat Flats, *Adamson* 2631 (BOL, holo., PRE, iso!).

Plants up to 40 cm high. *Roots* thin, reddish. *Stem* forming a short, vertical, woody base giving rise to several short, woody branches which end in congested, leafy shoots, densely covered by membranous tubular leaf-bases. *Leaves* many per shoot, lamina linear, up to 30 cm long, ca. 5 mm broad, keeled, glabrous or slightly muricate, soft in texture, tapering to an elongated point. *Inflorescence* about as long as the leaves or overtopping them, simple or with a few short, basal branches, glandular-hispid, laxly flowered; scape arcuate below terete, fairly stout; bracts small, deltoid, cuspidate; pedicels up to 2 cm long at first erect and short, later curved downwards, with the fruit facing the scape. *Flowers* with a white, dark keeled, maculate perianth, glandular hispid on the outside, segments 1 cm long; filaments muricate; ovary with 2 ovules per cell. *Capsule* globose, 8 mm in diam., densely covered with dendroid, gland-tipped excrescences, with a short stipe, hidden by covering. *Seeds* grey, 3 mm long, ovoid, flattened, verrucose with hard, rough, irregular ligulae and wings around the sides.

FLOWERING PERIOD: September–October.

DISTRIBUTION: Cape, on sand dunes on the Peninsula, to Bredasdorp in the east, Hopefield in the west.

CAPE.—Bredasdorp: Cape Agulhas, *Esterhuysen* 4386 (BOL). Caledon: Onrust River, near coast, *Esterhuysen* 4247 (BOL). Peninsula: Kommetjie, *Wolley Dod* 3604 (BOL); Retreat near Flora Road, *Salter* 8484 (BOL); *Adamson* 2628 (BOL). Hopefield: near Hopefield, *Wilman* 2446 (BOL), *Leighton* 456 (BOL).

In appearance this species resembles *T. scabra* very much but the round, densely covered capsule, which is also larger, separates it from that species. A small stipe is



present at the base of the capsule but it is not visible, being hidden by the dense covering. The plants also seem somewhat taller and the pedicel and the outside of the perianth are more densely glandular-hispid than in *T. scabra*.

40. *T. glandulosa* (Dint.) Oberm., comb. nov.

*Anthericum glandulosum* Dint. in Fedde, Rep. 29: 266 (1931); Poelln. in Fedde, Rep. 52: 236 (1943); includ. var. *montis-ruschii* Poelln. in Fedde, Rep. 52: 236 (1943). Type: South West Africa, Windhoek: Ruschberg, *Rusch* in herb. Dinter 4381 (B. holo. PRE, photo.). Type of var.: from the same locality, *Rusch* Jnr. in herb. Dinter 7921, (B! PRE, photo.).

Plants glandular, up to 30 cm high. *Roots* many, hard, stout but not swollen, about 2 mm in diam. *Stem* short, lateral, woody, covered with old leaf fibres, forming short branches which end in leafy shoots. *Leaves* linear up to 20 cm long, 4 mm broad, keeled, hard, glaucous, covered with gland-tipped, scabrid points, the glands disappearing with age, raphides many, distinct; tubular leaf-base membranous and with hard dorsal nerve-bundles disintegrating into fibres. *Inflorescence* a divaricate raceme, glandular hispid, many flowered; scape up to 7 cm long, much shorter than raceme, the latter overtopping the leaves; bracts ovate, subulate, up to 6 mm long; pedicels up to 12 mm long, patent, erect. *Flowers* with a white, brown keeled maculate perianth with a few glands on the outside, segments 9 mm long; filaments retrorsely scabrid; ovary few ovuled. *Capsule* small, 5 mm long, sparsely and shortly glandular-hispid, contracted at the base into a short stipe. *Seeds* verrucose, 1-2 per loculus.

FLOWERING PERIOD: January.

DISTRIBUTION: Only known from the type locality, Ruschberg, district Windhoek in South West Africa.

41. *T. asperata* Kunth, Enum. 4: 574 (1843); aggregate species.

Plants up to 1 m high, variable in size and amount of glandular pubescence. *Roots* many, firm, sometimes slightly fusiform near the tips. *Rhizome* compact, woody, sometimes forming a very short, woody stem, covered with fibres from old leaf-bases. *Leaves* many, filiform, linear and keeled or triquetrous 20-40 cm long, 1-5 mm broad, glabrous or minutely glandular pubescent and with some sparse setae in some; with minutely papillate ridges, soft, glabrous, long tapered to the apex, base membranous, tubular, the dorsal nerve bundle persisting as fibres. *Inflorescence* a divaricately branched raceme, often with unequal accessory branches or vestiges of these in the lower axils, seldom simple through reduction, overtopping the leaves: scape terete, glabrous or sparsely glandular scabrid or with some sparse setae; bracts small, deltoid, subulate; pedicels up to 12 mm long, erect, patent, recurved or contorted in fruit, usually glabrous. *Flowers* with a spreading perianth, white or pink, dark keeled, maculate with green spots, these occasionally faint, sometimes sparsely glandular outside, segments 1 cm long; filaments scabrid the same colour as the perianth; ovary verrucose, each wart capped with a rod-like, unicellular gland; with 4-6 anatropous ovules (embedded in a fold of the placenta) in each loculus. *Capsule* 5 mm globose or obtriangular, with some transverse ridges, constricted below, sparsely to densely covered with simple, elongated, gland-tipped tubercles. *Seeds* verrucose, grey, ridges winged.

FLOWERING PERIOD: September-December.

DISTRIBUTION: Eastern Cape, Natal, Orange Free State, Swaziland, Transvaal. Found in marshy ground or on stony hills.



## KEY TO VARIETIES

- Capsule densely and evenly covered with short, gland-tipped tubercles, or occasionally nearly glabrous, globose; leaves flat and keeled or triquetrous, glabrous or with a pubescence of short or long hairs; usually found in marshy places:
  - Pedicels scabrid, twisted in fruit; inflorescence divaricately branched or simple through reduction; plants up to 25 cm high (eastern Cape, Orange Free State, Swaziland):
    - Inflorescence laxly flowered; leaves straight or twisted (eastern Cape, Orange Free State) (a) var. *asperata*
    - Inflorescence densely flowered, densely glandular-hairy; leaves straight (Swaziland, eastern Transvaal)..... (b) var. *swaziensis*
    - Inflorescence simple or branched, nearly glabrous, few to many flowered; leaves straight, filiform, minutely pubescent (glabrous to the naked eye); small plants (Orange Free State, eastern Transvaal)..... (c) var. *carolinensis*
    - Pedicels glabrescent, erecto-patent up to 15 mm long in fruit; inflorescence with ascending branches; plants up to 50 cm high (Natal, Swaziland, eastern Transvaal) (d) var. *nataglencoensis*
  - Capsule sparsely covered with short, gland-tipped tubercles, obtriangular in outline, with some transverse ridges; leaves terete, plants grasslike, nearly glabrous; usually found on mountain grasslands:
    - Pedicels erect up to 15 mm long:
      - Inflorescence divaricately branched (eastern Cape, Orange Free State, Transvaal) (e) var. *macowanii*
      - Inflorescence simple or few-branched, flowers many, at first congested, pedicels thin and long (Natal, East Griqualand)..... (f) var. *stenophylla*
      - Pedicels twisted, up to 7 mm long (Basutoland, Orange Free State, eastern Cape, Transvaal highveld)..... (g) var. *basutoensis*

(a) var. *asperata*.

*T. asperata* Kunth, Enum. 4: 574 (1843). Type: Cape, Albert: New Hantam Mountains, in stony places, 4500–5000 ft. Feb. *Drege* 8735 (G, iso. ! PRE, photo.).

*T. humilis* Kunth, Enum. 4: 574 (1843). Type: Cape, Albany, *Drege* 8734 (P, iso, PRE, photo.).

*Anthericum kunthii* Bak. in Fl. Cap. 6: 392 (1897). As there is an Abyssinian species, *Anthericum humile* Hochst., Baker changed the epithet to *A. kunthii*. He could not trace the locality but the Paris sheet bears an original label with "Albany" on it which must be correct.\*

CAPE.—Mount Currie: Kokstad, Tyson 1983 (PRE).

ORANGE FREE STATE.—Bethlehem: *Phillips* 3115 (PRE), *Potgieter* 85 (PRE). Kroonstad: *Pont* 395 (PRE).

(b) var. *swaziensis* Oberm., var. nov. Racemus densus, dense glanduloso pubescens, folia stricta.

SWAZILAND.—Mbabane, *Compton* 25240 (PRE, holo.; Swaziland Herb. iso.).

TRANSVAAL.—Ermelo, *Gunn* (PRE, 28726).

(c) var. *carolinensis* Oberm., var. nov. Racemus glabrescens, folia stricta minute pubescentia, planta minora.

TRANSVAAL.—Carolina: *Galpin* 12212 (PRE, holo.). Ermelo: Ermelo, *Convent pupils* 85 (PRE), *Louw* 23 (PRE); Mavriestad, *Pott* 5177 (PRE). Middelburg: Klein Olifants River near Middelburg, *Young* A119, A8 (PRE).

(d) var. *nataglencoensis* (O. Kuntze) Oberm., stat. et comb. nov.

*Anthericum nataglencoense* O. Kuntze, Rev. Gen. 3, 2: 315 (1898). Type: Natal, Glencoe, *Kuntze* (K, holo.). *A. aggericolum* Poelln. in Bol. Soc. Brot. 16, 2: 50 (1942). Type: Natal, New Hanover: Dalton, *Rudatis* 7 (B, holo. ! PRE, photo.). *A. monticolum* Poelln. in Bol. Soc. Brot. 16, 2: 56 (1942). Type: Natal, Estcourt: mountains near Estcourt, *Schlechter* 3349 (B, holo. ! PRE, photo.). *A. natalense* Poelln. in Bol. Soc. Brot. 16, 2: 58 (1942). Type: Natal, Inanda: Verulam, Phoenix, *Schlechter* 2920 (B, holo. ! PRE, photo.).

\* Add to synonymy: *Anthericum asperatum* (Kunth.) Bak. in J. Bot. Lond. 1872, 138; J. Linn. Soc. 15: 310 (1876); in Fl. Cap. 6: 392 (1897). *A. sub-contortum* Bak. in Fl. Cap. 6: 390 (1897). Type: Cape, Griqualand East, *MacOwan & Bolus* (Bol. 1206, holo.).

NATAL.—Weenen: Estcourt Pasture Research Station, *Acocks* 10815 (NH, PRE). Inanda: *Wood* 457 (NH). Pietermaritzburg: Scottsville, *Allsop* 140 (NH). Zululand: Mtunzini, Gingindhlovu, *Lawn* 1195 (NH).

ORANGE FREE STATE.—Kroonstad: *Pont* 486 (PRE, SRGH). Harrismith: vlei near Harrismith, *Schweikerdt* 867, 868 (PRE).

TRANSVAAL.—Pretoria: Fairy Glen near Pretoria, *Leendertz* 1636 (PRE). Johannesburg: marsh, *Moss* 6041, 17768 (PRE). Ermelo: Ermelo, *Convent Sisters* 7 (PRE): Nooitgedacht, *Henrici* 1668 (PRE) *Gunn* (PRE). Witbank: Steenkoolspruit, *Kies* 389 (PRE), *Rogers* 24304 (NH).

(e) var. *macowanii* (Bak.) Oberm., stat. et. comb. nov.

*Anthericum macowanii* Bak. in J. Linn. Soc. 15: 309 (1876) et in Fl. Cap. 6: 390 (1897). Type: Cape: Albany, Grahamstown, *MacOwan* 64 (K, holo.).

CAPE.—Albany: Grahamstown, *Glass* 564 (GRA). Uitenhage: Baakens Valley, *Cruden* 353 (GRA, SRGH). Queenstown: mountain sides, near Queenstown, *Galpin* 1569 (PRE). Aliwal North: Elandshoek, *F. Bolus* (PRE, 176). Bathurst: Hopewell, *Acocks* 11052 (PRE). Middelburg: Gryskop, *Archibald* 3146 (GRA). Between Umtata and Maclear, *Bolus* 8710 (BOL).

ORANGE FREE STATE.—Philippolis: *Smith* 4589 (PRE).

TRANSVAAL.—Vereeniging: *Burt Davy* (PRE, 5569). Benoni: *Verdoorn*, 826 (PRE). Germiston: Elandsfontein, *Prosser* 1150 (PRE).

(f) var. *stenophylla* (Bak.) Oberm., stat. et comb. nov.

*Anthericum stenophyllum* Bak. in Bull. Herb. Boiss. Ser. 2: 781 (1901). Type: Natal Lion's River: Nottingham Road, *Wood* 5235 (Z, holo.! PRE, photo.).

CAPE.—Mount Currie: Kokstad, *Tyson* 1820 (BOL); Mt. Currie, *Hutchinson* 1824 (PRE).

NATAL.—Alfred: near Weza, *Killick & Marais* 2015 (PRE). Umzinto: Alexandra, Dumisa, *Rudatis* 446 (L.). Lion's River: Lidgetton, *Mogg* 834 (PRE).

(g) var. *basutoensis* (Poelln.) Oberm. stat. et comb. nov.

*Anthericum basutoense* Poelln. in Bol. Soc. Brot. 16, 2: 51 (1942). Type: Basutoland, *Dieterlen* 669 (B, holo.! NH, iso.! PRE, photo.).

CAPE.—Aliwal North: Doctor's Drift, *Gerstner* 249 (PRE). Barkly East: *Gerstner* 177 (PRE).

ORANGE FREE STATE.—Fauresmith: *Pont* in herb. *Henrici* 2880 (PRE), *Verdoorn* 1041 (PRE), *Smith* 5609, 5576 (PRE). Ficksburg: *Galpin* 13919 (PRE). Bloemfontein: *Potts* 1989 (BOL), *Bolus* (BOL 11179), *Dix* (BOL 17476).

BASUTOLAND.—Mokhotlong, *Liebenberg* 5678 (PRE); Mafeteng, Likhoel, *Dieterlen* 1221, 1220 (PRE); Mohale's Hoek, *Marais* 1076 (PRE).

TRANSVAAL.—Lichtenburg: Hakboslaagte, *Kings* 1982 (PRE). Pretoria: Irene, *Smith* 3520 (PRE).

The species is best treated as a very variable one. Although certain forms are very uniform in certain areas, intermediates were found which upset the idea of separate species. Moreover, it was observed that a certain form would crop up in a different area, e.g. var. *macowanii* from Grahamstown could not be separated from plants collected near Benoni and other localities. This happened repeatedly in all the varieties. Neither did a study of the habitat assist in separating them. It was seen that similar plants were reported to be growing on grassy mountain slopes or in marshy ground. The varieties with the twisted pedicels showed a parallel development to those that have erect pedicels; in both the degree of pubescence varied considerably.

42. *T. capillata* (Poelln.) Oberm., comb. nov.

*Anthericum pilosum* Bak. in Fl. Cap. 6: 395 (1897); non Jacq. *A. capillatum* Poelln. nom. nov. for *A. pilosum* Bak. in Fedde, Rep. 50: 232 (1941). Type: Cape, Mount Currie: Clydesdale, *Tyson* 2114 (K, holo., B. PRE, GRA, iso.!).

Plants up to 60 cm. *Roots* uniform, fibrous, many. *Rhizome* small covered with leaf fibres. *Leaves* linear, up to 45 cm, triquetrous, each face 6 mm wide, herbaceous, softly and patently pilose with long hairs, margins, prominent. *Inflorescence* branched or simple, flowers somewhat congested near the apex, many flowered, with a few scattered stipitate glands; scape terete, pilose, bracts small, subulate; pedicels patent, up to 17 mm long. *Flowers* with a spreading white, dark keeled, maculate perianth, segments 9 mm long, filaments swollen and retrorsely scabrid above, glabrous below, the 3 inner situated in the furrows of the triquetrous ovary; ovary with 4 ovules per cell, globose, with minute papillate glands. *Capsule* unknown.

FLOWERING PERIOD: February.

DISTRIBUTION: Only known from the type locality, Griqualand East and from the Alfred District of Southern Natal, at altitudes of  $\pm 3,000$  ft.

CAPE.—Mount Currie: Clydesdale, Tyson 2114 (K, holo., B, PRE, GRA, iso!).

NATAL.—Alfred: near Harding "Nongoni Veld" Acocks 13439 (PRE); Harding, Oliver 71 (NH).

Possibly a form of *T. gerrardi* but this cannot be decided until the capsules are known.

43. *T. erythrorrhiza* (Conrath) Oberm., comb. nov.

*Anthericum erythrorrhizum* Conrath in Kew Bull. 1914, 135. Type: Transvaal, Germiston, Modderfontein Conrath 777 (K, GZU, holo.! PRE, photo.).

Plants solitary or gregarious, up to 80 cm high. *Roots* spreading, uniform, hard, stout, up to 4 mm in diam., white at first becoming orange-red. *Rhizome* creeping, woody, covered with fibres. *Leaves* somewhat distichous, young tubular leaf-bases pink; lamina flat, erect often with a twist, firm, somewhat fleshy, linear-lanceolate, up to 40 cm long, 6 mm broad, shortly and sparsely pubescent, striate, midrib prominent below and excentric. *Inflorescence* erect, simple or with 1–2 ascending basal branches, up to 80 cm high; scape minutely and patently pubescent below, glandular pubescent above when young; bracts small, membranous, apiculate; pedicels ascending in flower, patent-erect in fruit and then up to 18 mm long. *Flowers* with perianth glabrous, white with yellow maculae, segments 10 mm long; stamens spreading shortly scabrid; ovary glandular-pubescent with 4 ovules per cell. *Capsule* globose, ca. 6 mm in diam. stipitate, covered with short, glandular tubercles. *Seeds* grey, verrucose, globose, tetrahedral, 3 mm in diam.

FLOWERING PERIOD: October.

DISTRIBUTION: Transvaal Highveld, black turf marshes.

TRANSVAAL.—Johannesburg: Wattles, Moss 13659 (J, PRE); Palmietfontein, Gilliland (Moss H. 26147); near Johannesburg, Ommanneng (in herb. Galpin 7156, PRE). Pretoria: Baviaanspoort, Smith 788 (PRE) Leendertz (TM 6439, PRE); Derdepoort, Leendertz (TM 4032, PRE).

44. *T. gerrardii* (Bak.) Oberm., comb. nov.

*Anthericum gerrardii* Bak. in J. Bot. Lond. 1872, 137; in Gard. Chron. 1876, 6: 100 et in Fl. Cap. 6: 395 (1897). Type Natal, Zululand, Gerrard 1527 (K, BOL, holo.! PRE, photo.). *A. tortifolium* O. Kuntze, Rev. Gen. 3, 2: 315 (1898). Type: Cape; Uitenhage, near Zwartkops River, Ecklon & Zeyher, Asphod. 110 (B, holo.! NBG, iso.! PRE, photo.). *A. montium-draconis* Poelln. in Bol. Soc. Brot., Sér. 2, 16: 57 (1942). Type: Natal, Charlestown. Thode (B, holo.! PRE, photo.).

Plants up to 60 cm. *Roots* long, spreading, thin near the rhizome but younger parts fusiform. *Rhizome* compact, woody, densely covered with fibres. *Leaves* triquetrous, variable in length and width, 10–40 cm long, each face 2–10 mm broad, with patent setae, margin prominent, often minutely glandular papillate. *Inflorescence* a divaricate raceme, often with accessory branches in lower axils; flower buds at first congested at the apex, rhachis elongating during anthesis, and the capsules eventually



laxly arranged; scape and side branches setose or with scabrid, obtuse tubercles, topped with stipitate, evanescent glands and often very densely glandular-pubescent; bracts variable in size, lowest up to 3 cm including the very long soft awn, upper floral bracts small, deltoid, subulate, keel glandular-pubescent; pedicels at first ascending, later patent, finally with the apex recurved or sometimes making a complete loop, up to 15 mm long, densely to sparsely scabrid-glandular, very seldom glabrous. *Flowers* with perianth glandular on the outside, white, dark-keeled, maculate with purple spots (Munro), segments spreading 10–15 mm long; filaments scabrid, erect; ovary densely glandular pubescent, with 4–6 ovules per cell. *Capsule* globose, 1 cm in diam. stipitate, densely covered with long pectinate tubercles which are gland-tipped. *Seeds* round, 2 mm in diam. shortly verrucose, dark, ridges suppressed except for a small ridge near hilum.

FLOWERING PERIOD: October–February.

DISTRIBUTION: Eastern Cape, Natal, Zululand, Swaziland, Eastern Transvaal. On grassy mountain slopes or in marshes.

CAPE.—Alexandria: Bushmans River Poort, *Archibald* 5325 (PRE); Ghio Bridge, *Archibald* 5292 (PRE). Port Elizabeth: Port Elizabeth, St. George's Park, *Urton* 333 (GRA). Albany: Grahamstown, *MacOwan* 1454 (GRA); Trapp's Valley, *Daly* 618 (PRE). Komgha: near Komgha, *Flanagan* 576 (PRE). Kentani: *Pegler* 1379 (GRA). East London: *Rattray* 580 (GRA). Molteno: Boesmanshoek Pass, *Acocks* 18691 (PRE). Mount Currie: near Clydesdale, *Tyson* 2123 (BOL).

NATAL.—Weenen: South Downs, *Evans* 364 (NH). Estcourt: foot of Griffin's Hill, *Acocks* 11215 (PRE); Dalton Bridge, *Munro* (PRE). Inanda: *Wood* 432 (NH). Zululand: Lower Umfolosi: near Ntambanana *Codd* 1891 (PRE). Mtunzini: Inyesani, *Gerstner* (NH 22651); Amatikulu, *Mogg* 5794 (PRE).

SWAZILAND.—Mbabane, *Compton* 25212 (PRE).

TRANSVAAL.—Wakkerstroom: *van Dam* (TM 24348, PRE).

The following specimens have very narrow leaves:—

TRANSVAAL.—Barberton: *Pott* 5559 (PRE); Abbott's Hill, *Galpin* 1036 (PRE). Nelspruit: *Codd* 9393 (PRE). Ermelo: *Pott* (TM 15119, PRE); *Henrici* 1092 (PRE).

NATAL.—Giant's Castle: *Symons* (TM 25267, PRE).

The large round, rough capsule is typical for this species. Without it some specimens are not easily distinguished from *T. asperata* but *T. gerrardii* is usually a much coarser and more scabrid plant.

45. *T. giffenii* (Leighton) Oberm., comb. nov.

*Anthericum giffenii* Leighton in J. S.A. Bot. 10: 59 fig. 2 (1944). Type: Cape, Victoria East, 23 miles from Alice, farm Naude's Hoek, shady places in kloof and on dry hillside. *Giffen* 783 (BOL, holo.), 783b (PRE, NH, iso.).

Plants succulent up to 50 cm high, in clumps. *Roots* somewhat fleshy. *Rhizome* creeping, stout, without fibres. *Leaves* somewhat distichous, 10–12 per shoot, linear-lanceolate, triquetrous, up to 50 cm long, each face ca. 12 mm broad, tapering gradually to the apex, herbaceous, with a short, soft pubescence. *Inflorescence* a few-branched raceme or simple, varying in length, up to 150 cm high, glandular pubescent; scape pubescent; bracts small, ovate, acuminate, membranous; pedicels patent, up to 2 cm long, apex recurved in fruit. *Flowers* with perianth spreading, white, green-keeled, maculate, glandular pubescent on the outside, segments up to 15 mm long; stamens declinate, scabrid; ovary glandular, placed on a disk; ovules 2 in each cell. *Capsule* rough, glandular, producing lateral horns ca 5 mm long. *Seed* brownish with a well marked hilum.

FLOWERING PERIOD: September–March.

DISTRIBUTION: Eastern Cape.



CAPE.—Victoria East: near Alice, *Giffen* 783 (BOL, holo.), 783b (PRE, NH, iso.). Somerset East: Middleton, False Karroid Broken Veld, on shale, occasional on S. aspect, *Acocks* 21687 (PRE).

The horned capsules are unusual.

THE FOLLOWING SPECIES FOUND OUTSIDE SOUTHERN AFRICA ARE HERE PUT UNDER  
TRACHYANDRA\*

***T. pyrenicarpa* (Welw. ex Bak.) Oberm., comb. nov.**

*Anthericum pyrenicarpum* Welw. ex Bak. in Trans. Linn. Soc. Ser. 2, Bot. 1: 259 (1878) et in F.T.A. 7: 491 (1898). Type: Angola, Huilla, in damp pastures between Humpata and Gambas, *Welwitsch* (BM, holo.). Near *T. saltii* but capsules with one large seed in each locule.

***T. malosana* (Bak.) Oberm., comb. nov.**

*Anthericum malosanum* Bak. in Flor. Trop. Africa 7: 492 (1898). Type: Nyasaland, Mount Malosa, *Whyte* (K, holo.! PRE, photo.). Southern Rhodesia: Inyanga, Mtenderere Source, *Wild* 1465 (SRGH). Very near *T. asperata* and may be conspecific.

UNCERTAIN SPECIES

*Anthericum ensifolium* Sölch in Mitt. Bot. Staatssamm. München II: 175, 1956. Type: South West Africa, Maltahöhe: Farm Friedland, *Walter* 2113 (M. holo.! PRE, photo.). The type consists of a rosette of leaves which emerge from a "neck" consisting of scaly leaf-bases. There is a detached part of a branched raceme which resembles that of *Trachyandra laxa*. I doubt whether the leaves belong to the inflorescence and am inclined to consider it a *nomen confusum*.

*A. omissum* Poelln. in Bol. Soc. Brot., Sér. 2, 16: 59 (1942). Type: Cape, locality and collector unknown (B, holo.). This is possibly *Trachyandra saltii* (Bak.) Oberm.

NOMEN CONFUSUM

*A. praetermissum* Poelln. in Bol. Soc. Brot. 16, 2: 62 (1942). In his description Poellnitz notes that the collector and locality were unknown. The type is preserved in the Berlin Herbarium and is an *Ecklon & Zeyher* specimen, *Asphod.* 106, from mountains near Simonstown, Cape. Mounted on this sheet is a sterile plant of *T. hirsuta* together with a loose inflorescence of an *Urginea* sp. As Poellnitz described the leaves of *T. hirsuta* and the flowers of an *Urginea*, his species is a *nomen confusum*. At Kew this *Ecklon & Zeyher* number is a syntype of *T. brachypoda* (Bak.) Oberm.

TYPES OF ANTHERICUM AT BERLIN

Dr. Buchheim, in a letter dated 29-11-58, writes that during the war the types were stored somewhere else and survived. In the Liliaceae however, the types and other material were sent to von Poellnitz in Thuringia. In this way much material was saved that would have perished otherwise in the fire of March 1943. On the other hand not all the material loaned to von Poellnitz came back to Berlin for his house was bombed and the material there, but for a few sheets, was destroyed. It is possible that amongst these were types of *Anthericum* and *Chlorophytum*.

\**Anthericum zavatterii* Cuf., Miss. Biol. Racc. Bot. 4: 308, fig. 100 (1939). Type: Kenya, Moyale, Miss. Biol. 689 (RO, holo.). It was put in the section *Trachyandra* by Cufodontis. As the filaments are glabrous, the anthers basifixed and the perianth segments persistent, etc., it does not belong to the genus *Trachyandra*.

## ACKNOWLEDGMENTS

For their kind co-operation, loan of specimens, gifts of photos and valuable advice, I wish to thank the Directors and Staff of the following institutions: B, BM, BOL, G, GRA, GZU, J, K, KMG, L, M, NBG, NH, NYS, P, PRE, SRGH, UPS, Z.

I am also much indebted to Mr. Wessel Marais, South African botanist at Kew, and to Mr. John Lewis of the British Museum for their kind assistance in comparing types and undertaking research into literature not available here. I am also most grateful to M. E. Connell (Mrs. Stutterheim) for the illustrations.

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# The Identity of the Fungus Causing Anthracnose of Olives in South Africa.

By

G. J. M. A. Gorter.

In South Africa all the diseases that affect olive trees are of fungal origin (Gorter, 1959). Of these, anthracnose is perhaps the most destructive. The fruit-decay for which it is responsible was known in the late twenties to occur in the coastal regions of the western Cape Province (Verwoerd, 1928). It was not before 1935, however, that the cause of the disease was identified as an anthracnose fungus of the *Gloeosporium* type.\*

When the writer investigated this disease in 1938, he was struck by the fact that the causal fungus produced a bright red pigment in its hyphae on various culture media. This was unlike the cultural characteristics that Biraghi (1934) had described for *Gloeosporium olivarum* Alm., a fungus which has, until now, been considered the only known agent of anthracnose in olives. In addition it was found that the disease could attack the flowers (Gorter, 1960), a symptom which had not been described before.

Thus the question arose whether the local anthracnose fungus should be considered a variant of *G. olivarum* Alm. or whether it was a closely related species. It was essential to compare it with olive anthracnose fungi from other parts of the world as well as with fungi responsible for similar fruit tree diseases. Investigations concerning these comparisons, a preliminary account of which has appeared elsewhere (Gorter, 1956) are reported in detail below.

## MATERIALS AND METHODS

As these investigations were started immediately prior to World War II, isolates of olive anthracnose fungi could be obtained only from a limited number of countries. In the first place, isolates were obtained from Portugal, the country from which the disease was originally described (Almeida, 1899). Other isolates came from Italy via the "Centraal Bureau voor Schimmelcultures" at Baarn, Holland and from California in the United States of America. Shortly after the war, cultures were obtained direct from Italy.†

Two aspects of the fungi were studied in detail viz. the cultural characteristics of the mycelium on various culture media and the morphology of spores produced on these media. The agar media used were prepared according to the specifications of Rawlins (1933). Colours of mycelium and acervuli were recorded by comparing with the standard colours described by Ridgway (1912). Spore measurements were made by suspending the spores in cooled melted water agar and examining a drop of the suspension between a slide and a cover slip under the microscope. The congealed agar prevented movement of the spores during measurement with an eyepiece micrometer.

\* Specimen No. 33360, Stellenbosch-Elsenburg Mycological Herbarium, collected by Dr. B. J. Dippenaar.

† The author is much indebted to Drs. R. V. de G. Cabral, Joh. Westerdijk, H. N. Hansen and A. Ciccarone for providing him with the respective cultures.

Valid conclusions about the dimensions of spores can be drawn only if the number of spores measured is enough to allow for a statistical analysis. According to Blumer (1926) at least 100 spores should be measured to obtain regular variation curves for length and width which are essential requirements for such an analysis. Thus measuring 100 spores from each isolate on a given substrate was adopted as a standard procedure.

The spore measurements were analysed in two different ways. To determine the modus, i.e. the most common spore size, the measurements were arranged in correlation tables similar to those used by Levine (1928). Differences in shape between the spores of the various fungi were determined by applying the discriminant function to spore measurements as proposed by Baten (1944).

Spore shapes of all the olive anthracnose isolates were determined. In addition the spore shapes of the anthracnose fungi from a few comparable diseases were studied, i.e. strains of *Glomerella cingulata* (Stoneman) Sp. & v. Schr., *Colletorichum gloeosporioides* Penz. and *Gloeosporium limeticolum* Clausen. They are respectively the cause of anthracnose in apples, oranges and limes. Cultures of these fungi were obtained from the "Centraal Bureau voor Schimmelcultures" with exception of a chromogenic strain of *Glomerella cingulata* which was kindly provided by Dr. M. C. Goldsworthy of Beltsville, Maryland in the United States of America.

Stock cultures of the fungi were maintained on oatmeal agar because it provided the best culture medium for the production of spores. On most other agar media, including potato-dextrose agar sporulation decreased with successive transfers and soon stopped altogether.

#### CULTURAL CHARACTERISTICS

In Table 1, the cultural characteristics of olive anthracnose isolates from four different countries situated in three continents have been compared on three agar culture media. The most striking difference between the South African isolate and the others is the entirely different colour of the substrate mycelium. In the three overseas isolates it is a shade of olive green but in the local fungus it is bright red.

Differences in pigmentation were also noted in the acervuli of the two types of fungi. This was shown by the following experiment. Sevillano olives were divided in two groups which were respectively inoculated with the W.P. (South Africa) and U.S.A. (California) isolates of the olive anthracnose fungi. After four days incubation under moist conditions at 27°C, an abundance of acervuli was produced on affected fruit. The acervuli of the W.P. isolate, had an "orange-rufous" colour while those of the U.S.A. isolate were "cinnamon rufous". On potato-dextrose agar their colours were "salmon-orange" and "apricot buff" respectively.

Similar differences in colour of substrate mycelium and acervuli were encountered if the W.P. isolate was compared with the anthracnose fungi from similar diseases except in the case of the chromogenic strain of *Glomerella cingulata*. The existence of a chromogenic strain characterized by the production of a red pigment on potato-dextrose agar was originally discovered by Shear & Wood (1913). In 1943 a similar strain was isolated by M. C. Goldsworthy from an unknown variety of apple near Washington, D.C. (Andes & Keitt, 1950). It was this strain that was compared with the W.P. isolate of the olive anthracnose fungus (see Table 2). The comparison shows that as far as cultural characteristics are concerned the differences between the two fungi are so small that they could be identical.



TABLE 1.—Cultural characteristics of four olive anthracnose isolates from four different countries on three agar media.

Cultural Characters *	Strain of the fungus	Agar Medium		
		Potato-dextrose	Oat-meal	Czapek-Dox
Development of aerial mycelium	W.P. (South Africa)	Well developed; hyphae somewhat loose	Sparsely developed; hyphae loose	Moderately developed; hyphae aggregated
	$\lambda a$ (Portugal)....	Well developed; hyphae loose	Moderately to fairly well developed; hyphae loose	Fairly well developed; hyphae fairly closely aggregated
	C.B.S. (Italy)....	Well developed; hyphae somewhat loose	Moderately developed; hyphae loose	Fairly well developed; hyphae closely aggregated
	U.S.A. (California)	Well developed; hyphae loose	Fairly well developed; hyphae loose	Fairly well developed; hyphae closely aggregated
Colour of aerial mycelium	W.P.....	Light greyish olive	Pale olive grey....	White.
	$\lambda a$ .....	White with dark greenish olive centre	White.....	White
	C.B.S.....	Greyish olive....	Dusky yellowish green	White
	U.S.A.....	Greyish olive....	Dusky olive green	White
Colour of substrate mycelium	W.P.....	Nopal red.....	Scarlet.....	Coral red
	$\lambda a$ .....	Yellowish olive to dark greenish olive	White with olivaceous black (2)	Cardridge buff
	C.B.S.....	Dark olive.....	Dusky yellowish green	Pale olive buff
	U.S.A.....	Olivaceous black (2)	Dusky olive green	Cardridge buff
Relative speed of mycelium growth	W.P.....	1	1	1
	$\lambda a$ .....	$\pm 5/6$	$\pm 5/6$	$\pm 5/6$
	C.B.S.....	$\pm 1$	$\pm 2/3$	$\pm 1$
	U.S.A.....	$\pm 2$	$\pm 2$	$\pm 2$

\*All descriptions were made of 7-days-old cultures, grown in the dark at 25°C.

TABLE 2.—Cultural characteristics of *Gloeosporium* spec. (W.P.) from olive and *Glomerella cingulata* (chromogenic strain) from apple, on three agar media.

Cultural Characters *	Fungus	Agar Medium		
		Potato-dextrose	Oatmeal	Czapek-Dox
Development of aerial mycelium	<i>Gloeosporium</i> spec. (W.P.)	Well developed; hyphae somewhat loose	Sparsely developed; hyphae loose	Moderately developed; closely aggregated
	<i>Glomerella cingulata</i> (chromogenic strain)	Well developed; hyphae loose	Sparsely developed; hyphae loose	Sparsely developed; closely aggregated
Colour of aerial mycelium	<i>Gloeosporium</i> spec. (W.P.)	Light greyish olive	Pale olive grey....	White
	<i>Glomerella cingulata</i> (chromogenic strain)	Light greyish olive	Pale olive grey....	White
Colour of substrate mycelium	<i>Gloeosporium</i> spec. (W.P.)	Nopal red.....	Scarlet.....	Coral red
	<i>Glomerella cingulata</i> (chromogenic strain)	Pomegranate purple	Old rose to deep vineaceous	Carmines to coral red
Relative speed of mycelium growth	<i>Gloeosporium</i> spec. (W.P.)	1	1	1
	<i>Glomerella cingulata</i> (chromogenic strain)	± 1	± 1	± 1

\* See footnote Table 1.

## SPORE MEASUREMENTS

The spore dimensions of *Gloeosporium olivarium* were originally described by Almeida (1899) as  $15-27 \times 4-6 \mu$ . Cabral (1941), who reinvestigated the disease in Portugal mentions the following dimensions:  $9.4-22.5 \times 3.7-5.6 \mu$ . In the case of the local olive anthracnose isolate the writer determined the dimensions from its natural habitat as being  $12.9-19.7 \times 3.7-6.4 \mu$  (Mean:  $16.48 \times 4.88 \mu$ ). This shows good agreement in spore size between the fungi from the two countries and if only this morphological character were taken into account there would be no reason to consider the local anthracnose fungus different from *Gloeosporium olivarium* Alm. However, it was observed that the olive anthracnose isolates from Italy and California, although culturally similar to the Portuguese isolates, had slightly thicker spores and a closer study of spore shapes was therefore considered necessary.

At first only culturally similarly looking fungi were compared including those from related anthracnose diseases. They were grown on oatmeal agar for about four weeks at a temperature of  $25^{\circ}\text{C}$ . Of each culture 100 acervuli spores were examined under the microscope at a magnification of  $900\times$ . In Table 3 the spore measurements are analysed according to mean, variation and modus. Results of comparisons between spore shapes according to their discriminant functions are given in Table 4. Modus

values as well as spore shapes show that the spores of *Gloeosporium olivarium* (4 Port.) and *G. limeticolum* are identical. The same applies to the spores of *Gloeosporium olivarium* (U.S.A.) and *Glomerella cingulata*. The spores of *Gloeosporium olivarium* (C.B.S.) and *Colletotrichum gloeosporioides* may also be considered identical in spite of the fact that the F-value for the difference in spore shape is significant (Table 6). Saunders (1939) has pointed out that the significance of a difference must be accepted with reservations if the number of degrees of freedom in a statistical analysis is very low unless the significance, i.e. the F-value, is very high. As this is not so in our case and as the modus of the spore measurements for both fungi is the same, the shape of their spores can be considered identical.

TABLE 3.—Spore sizes of six different anthracnose fungi from acervuli which had developed after four weeks' growth on oatmeal agar at 25°C.

Fungus Species	Spore sizes in $\mu$		
	Mean	Variation	Modus
<i>Glomerella cingulata</i> .....	12.57 $\times$ 5.12	10.0-14.1 $\times$ 4.6-5.8	12.5 $\times$ 5
<i>Gloeosporium olivarium</i> (C.B.S.).....	14.53 $\times$ 4.88	11.7-16.6 $\times$ 4.6-5.4	14.1 $\times$ 5
<i>Gloeosporium olivarium</i> (4 Port.).....	12.87 $\times$ 3.97	10.0-15.0 $\times$ 3.3-4.6	12.5 $\times$ 4.1
<i>Gloeosporium olivarium</i> (U.S.A.).....	12.31 $\times$ 5.06	10.0-14.1 $\times$ 4.2-5.8	12.5 $\times$ 5
<i>Gloeosporium limeticolum</i> .....	12.78 $\times$ 4.01	9.1-16.6 $\times$ 3.3-5.0	12.5 $\times$ 4.1
<i>Colletotrichum gloeosporioides</i> .....	14.26 $\times$ 5.24	12.5-15.8 $\times$ 4.6-5.8	14.1 $\times$ 5

TABLE 4.—Results of comparisons of the discriminant functions of spore shapes with reference to different combinations of anthracnose fungi.

Fungus Species	F-Value	Significance at 1% point*
<i>Gloeosporium olivarium</i> (4 Port.) and <i>Glomerella cingulata</i> ..	$\pm$ 424	Highly significant
<i>Gloeosporium olivarium</i> (4 Port.) and <i>Gloeosporium olivarium</i> (C.B.S.)	$\pm$ 317	Highly significant
<i>Gloeosporium olivarium</i> (4 Port.) and <i>Gloeosporium limeticolum</i>	$\pm$ 1.3	Not significant
<i>Gloeosporium olivarium</i> (4 Port.) and <i>Colletotrichum gloeosporioides</i>	$\pm$ 404	Highly significant
<i>Gloeosporium olivarium</i> (4 Port.) and <i>Gloeosporium olivarium</i> (U.S.A.)	$\pm$ 314	Highly significant
<i>Gloeosporium olivarium</i> (C.B.S.) and <i>Glomerella cingulata</i> ..	$\pm$ 225	Highly significant
<i>Gloeosporium olivarium</i> (C.B.S.) and <i>Colletotrichum gloeosporioides</i>	$\pm$ 7.5	Just significant
<i>Gloeosporium olivarium</i> (C.B.S.) and <i>Gloeosporium olivarium</i> (U.S.A.)	$\pm$ 182	Highly significant
<i>Gloeosporium olivarium</i> (U.S.A.) and <i>Glomerella cingulata</i>	$\pm$ 1.1	Not significant

\* Determined from the Tables of Fisher and Yates (1938)

Thus, the comparison showed that the culturally similar olive anthracnose isolates from different countries have, according to spore size, a closer resemblance to related anthracnose fungi than to each other. From this it might well be concluded that olives are subject to attack by a number of closely related anthracnose fungi. If this is indeed the case then a comparison of the spores of the local olive anthracnose fungus with those of the chromogenic strain of *Glomerella cingulata* as well as those of the Portuguese anthracnose fungus might be expected to throw more light on the identity

of the local fungus. The spores of the said fungi were therefore compared not only with each other but also with the spores of a number of other olive anthracnose isolates as well as those of *Gloeosporium limetticolum* and of *Colletotrichum gloeosporioides*. The fungi were again grown on oatmeal agar for four weeks at 25°C, but this time the acervuli spores were examined under the microscope at a magnification of 1100 ×. The spore sizes and differences in shape are shown in Tables 5 and 6 respectively.

TABLE 5.—Spore sizes of eight different anthracnose fungi from acervuli which had developed after four weeks growth on oatmeal agar at 25°C.

Fungus Species	Spore sizes in $\mu$		
	Mean	Variation	Modus
<i>Gloeosporium</i> species (W.P.).....	13.32 × 4.40	10.7-16.0 × 4.0-5.0	13.3 × 4.3
<i>Glomerella cingulata</i> (chrom. strain)...	12.53 × 4.55	10.0-15.3 × 4.0-5.3	12.7 × 4.7
<i>Gloeosporium olivarium</i> (4 Port.)....	12.93 × 4.25	10.0-16.7 × 3.7-5.0	13.3 × 4.3
<i>Gloeosporium limetticolum</i> .....	13.35 × 4.30	10.0-16.7 × 3.7-5.0	13.3 × 4.3
<i>Gloeosporium olivarium</i> (C.B.S.).....	14.37 × 5.15	12.0-16.7 × 4.7-6.0	14.0 × 5.3
<i>Colletotrichum gloeosporioides</i> .....	14.10 × 5.35	12.6-16.0 × 5.0-5.6	14.0 × 5.3
<i>Gloeosporium olivarium</i> (315, Italy)....	15.31 × 5.05	12.7-17.3 × 4.3-5.7	15.3-16.0 × 5.0
<i>Gloeosporium olivarium</i> (319, Italy)...	16.21 × 5.01	14.0-18.7 × 4.3-5.7	16.0 × 5.0

TABLE 6.—Results of comparisons between the discriminant functions of spore shapes with reference to different combinations of anthracnose fungi

Fungus Species	F-Value	Significance at 1% point*
<i>Gloeosporium</i> species W.P. and <i>Glomerella cingulata</i> (chrom. strain)	± 5	Just significant
<i>Gloeosporium</i> species W.P. and <i>Gloeosporium olivarium</i> (4 Port.)	± 7	Just significant
<i>Gloeosporium</i> species W.P. and <i>Gloeosporium limetticolum</i>	± 4	Not significant
<i>Gloeosporium</i> species W.P. and <i>Gloeosporium olivarium</i> (C.B.S.)	± 203	Highly significant
<i>Gloeosporium olivarium</i> C.B.S. and <i>Colletotrichum gloeosporioides</i>	± 22.5	Significant
<i>Gloeosporium olivarium</i> C.B.S. and <i>Gloeosporium olivarium</i> (315, Italy)	± 38	Significant
<i>Gloeosporium olivarium</i> (315, Italy) and <i>Gloeosporium olivarium</i> (319, Italy)	± 22	Significant

\* See footnote Table 4.

Table 5 shows that the modus values for the spores of both olive anthracnose fungi from Portugal and South Africa were identical while those for the chromogenic strain of *Glomerella cingulata* were but slightly different. Differences in the latter were in fact so small that for practical purposes their modus values could be considered identical with those of the two olive anthracnose fungi. This was confirmed by a comparison of their spore shapes (Table 6) which showed that differences in the shape between the spores of the local olive anthracnose fungus and those of the chromogenic strain of *Glomerella cingulata* were even smaller than between the spores of the two olive anthracnose fungi just mentioned. The identity of the spore sizes and shapes of the local anthracnose isolate from olives and *Gloeosporium limetticolum* from limes is obvious. The above findings and the fact that the spore size of *G. limetticolum* was



found identical with *G. olivarum* (4 Port.) all point to identical spore shapes in the anthracnose fungi from olives in Portugal and South Africa, the anthracnose fungus from limes and the chromogenic strain of the anthracnose fungus from apples.

On the other hand there was a distinct difference in shape between spores of the local olive anthracnose fungus and olive anthracnose isolates from Italy. This is found clearly expressed in the different modulus values. These values greatly resemble the values for *Colletotrichum gloeosporioides*, in fact they are identical for the C.B.S. isolate and *C. gloeosporioides*. A study of their spore shapes revealed the interesting fact that their differences were of the same order as between different isolates of *G. olivarum* in Italy. As the variability of *Colletotrichum gloeosporioides* is well known (Burger, 1921) those facts strengthen the possibility that anthracnose of olives in Italy is caused by strains of *Colletotrichum gloeosporioides*.

Although it has now been ascertained that the local anthracnose fungus of olives was not only culturally identical with the chromogenic strain of *Glomerella cingulata* but also identical as far as spore shape is concerned, the question remained how to name the fungus. The answer depended on whether this chromogenic strain should indeed be considered a form of *G. cingulata*. We have already seen that it differed from this fungus in having narrower, more pointed, spores. Moreover, Andes & Keitt (1950) stated that the chromogenic strain, and in fact all strains with narrow pointed atypical spores, have never produced perithecia, not even in cross breeding experiments. However, still another difference was found, viz. the way in which spores are produced on potato-dextrose agar. Shear & Wood (1913) already pointed out that the chromogenic strain produced an abundance of spores in the aerial mycelium of the fungus when grown on potato-dextrose agar. It was also noted that these spores were slightly smaller than those produced in the acervuli. The identical phenomenon was observed for the South African olive anthracnose fungus. It now remained to ascertain whether this phenomenon did also occur in cultures of *Glomerella cingulata* and *Colletotrichum gloeosporioides*.

Therefore, a chromogenic and a non-chromogenic strain of *Glomerella cingulata* were grown on potato-dextrose agar for four weeks at 25°C. For purposes of comparison, cultures of *Colletotrichum gloeosporioides*, *Gloeosporium limeticolum* and olive anthracnose isolates from Portugal, Italy and South Africa were also included in this test. Measurements were made of spores borne on the hyphae as well as in the acervuli. The measurements are recorded in Table 7. These show that all species with a spore width  $< 5 \mu$  have a spore size which depends on whether the spores were formed on the hyphae or in the acervuli. Fungi with a spore width  $> 5 \mu$  like *Colletotrichum gloeosporioides* and the non-chromogenic form of *Glomerella cingulata* are shown to possess negligible differences in the dimensions of the two types of spores.

While the mycelium spores were produced in abundance in the first group of fungi—spores narrower than  $5 \mu$ —they were sparsely formed in the second group giving the impression of being widely dispersed growing acervuli spores. The difference in the two groups of fungi is further illustrated in the following comparison of spore size variation in mycelium and acervuli spores of *Gloeosporium olivarum* ( $\lambda$  Port.) and *Colletotrichum gloeosporioides*. For *C. gloeosporioides* the variation in length and width of both types of spores were practically the same:—

variation mycelium spores:  $9.1-17.1 \times 4.0-6.3 \mu$ ,

variation acervuli spores:  $12.5-18.3 \times 4.5-6.3 \mu$ .

In the case of *Gloeosporium olivarum* ( $\lambda$  Port.) there is no such overlapping of the variations:—

variation mycelium spores:  $4.5-10.3 \times 2.3-4 \mu$ ,

variation acervuli spores:  $9.1-14.9 \times 3.4-4.6 \mu$ .

The figures show clearly that in this case *two* kinds of spores are involved.

TABLE 7.—Mean spore dimensions in  $\mu$  of different anthracnose fungi after four weeks growth on potato-dextrose agar at 25°C

Fungus Species	Mycelium spores		Acervuli spores	
	Length	Width	Length	Width
<i>Gloeosporium olivarium</i> (Aa Port.)	7.02 $\pm$ 0.12	3.12 $\pm$ 0.04	11.82 $\pm$ 0.11	4.09 $\pm$ 0.03
<i>Gloeosporium olivarium</i> (4 Port.)*	8.61 $\pm$ 0.13	3.51 $\pm$ 0.03	12.97 $\pm$ 0.16	4.37 $\pm$ 0.04
<i>Gloeosporium limetticolum</i> .....	10.41 $\pm$ 0.17	3.63 $\pm$ 0.04	13.00 $\pm$ 0.15	4.43 $\pm$ 0.05
<i>Gloeosporium spec.</i> (W.P.).....	9.57 $\pm$ 0.14	3.60 $\pm$ 0.05	13.88 $\pm$ 0.10	4.40 $\pm$ 0.07
<i>Glomerella cingulata</i> (chrom. strain)	7.79 $\pm$ 0.16	3.40 $\pm$ 0.04	13.70 $\pm$ 0.12	4.77 $\pm$ 0.05
<i>Glomerella cingulata</i> .....	11.19 $\pm$ 0.14	5.00 $\pm$ 0.04	11.84 $\pm$ 0.11	5.13 $\pm$ 0.07
<i>Gloeosporium olivarium</i> (C.B.S.)	13.30 $\pm$ 0.13	5.00 $\pm$ 0.04	13.99 $\pm$ 0.09	4.97 $\pm$ 0.03
<i>Colletotrichum gloeosporioides</i> ..	14.01 $\pm$ 0.23	5.14 $\pm$ 0.04	14.16 $\pm$ 0.13	5.34 $\pm$ 0.06

\* Mycelium spores entirely free from acervuli spores could not be obtained.

#### DISCUSSION AND CONCLUSIONS

The foregoing investigations have established firstly that the local anthracnose fungus of olives is morphologically and culturally indistinguishable from the chromogenic strain of *Glomerella cingulata* that Dr. M. C. Goldsworthy isolated from apples. Secondly it was shown that isolates of *Gloeosporium olivarium* and related anthracnose fungi fall into two groups which are defined as follows:—

- (a) the *Glomerella-Colletotrichum* group which is characterized by conidio-spores with a width modus equal or larger than 5  $\mu$  and which although very variable in size, have similar dimensions on potato-dextrose agar whether borne on individual hyphae or in acervuli.
- (b) the *Gloeosporium* group characterized by conidiospores with a width modus smaller than 5  $\mu$  and which produces two types of spores—micro and macro-conidia—on potato-dextrose agar, each with comparatively little variation in size. In this type of anthracnose fungus production of perithecia has never been observed.

It could be asked, however, whether distinctions based on differences in spore size are valid reasons for distinguishing anthracnose fungi. Some investigators (Krüger, 1913, Burger 1921) maintain that spore size is not a good criterion. However, they base their opinions largely if not exclusively on the large variability in the length of spores and fail to appreciate the importance of spore width as a shape-giving factor. The foregoing experiments have clearly shown that under varying conditions of growth the width of spores varies much less than the length. In addition the statistical analyses carried out showed that with regard to spore shape width was a more important factor than length. Therefore, in the opinion of the author, spore dimensions, or rather spore widths, may undoubtedly be used as a differential character for the identification of anthracnose fungi.

From the description of the two groups it is obvious that the chromogenic strain of *Glomerella cingulata* falls into the second group and its designation as *Glomerella cingulata* is therefore incorrect. In this connection it should be remembered that Edgerton (1915) has already distinguished between perithecia-forming and non-perithecia-forming anthracnose fungi from apples, identifying the latter by the name *Gloeosporium fructigenum* Berk. and that the author of the name (Berkeley, 1856) has noted that the spores of this fungus were not as variable as those from

a similar perithecia-forming isolate from grapes. The chromogenic strain and the identical South African anthracnose fungus from olives should therefore be considered a form of *Gloeosporium fructigenum* Berk. They could be conveniently called *Gloeosporium fructigenum* Berk. f. *chromogenum* Gorter form. nov. [=M. C. Goldsworthy's chromogenic strain of *Glomerella cingulata* (Stoneman) Spauld. & v. Schrenk loc. cit.]. This fungus causes apparently not only an anthracnose disease of apples and olives but also of peaches (Ramsay et al. 1951).

The identity in spore size and the similarity of most cultural characteristics in *G. fructigenum* Berk. f. *chromogenum*, *G. olivarum* Alm. from Portugal and *G. limetticolum* Clausen show that these three fungi are very closely related and it is felt that this should be expressed in the name. Hence, *Gloeosporium olivarum* Alm. should be renamed *Gloeosporium fructigenum* Berk. f. *olivarum* (Alm.) Gorter comb. nov. [= *Gloeosporium olivarum* Alm. loc. cit.] while *Gloeosporium limetticolum* Clausen should be called *Gloeosporium fructigenum* Berk. f. *limetticolum* (Clausen) Gorter comb. nov.

The investigations have also shown that *Gloeosporium fructigenum* f. *olivarum* and *Gloeosporium fructigenum* f. *chromogenum* are apparently not the only fungi capable of causing anthracnose disease in olives. There is evidence that olives are also subject to attack by *Colletotrichum gloeosporioides* Penz. from citrus and *Glomerella cingulata* (Stoneman) Spauld. & v. Schrenk from apples. The similarity of Italian isolates of olive anthracnose fungi and *Colletotrichum gloeosporioides* Penz. is strengthened by the fact that Ciccarone (1947) discovered the presence of long flexible hyphae at the periphery of the acervuli in Italian isolates which remind one somewhat of setae. Von Arx (1957 a), who most probably studied the Italian isolate present in the "Centraal Bureau voor Schimmelcultures" even goes so far as to consider *Gloeosporium olivarum* Alm. a synonym for *Colletotrichum gloeosporioides* Penz. As at present the latter fungus is commonly indicated by its perithecial stage it should be called *Glomerella cingulata* (Ston.) Spauld. & v. Schrenk var. *crassispора* Wr. in accordance with the terminology used by Wollenweber & Hochapfel (1949) so as to distinguish it from the apple anthracnose fungus which the same authors have called *Glomerella cingulata* (Ston.) Spauld. & v. Schrenk var. *brevispora* Wr.

After completion of the present comparative study of olive anthracnose fungi, von Arx (1957 b) has published an extensive revision of the genus *Gloeosporium*. If his opinion—that *Gloeosporium* should be dropped in favour of *Colletotrichum* as a generic name—finds international recognition, then the above described forms of *Gloeosporium fructigenum* should be referred to as forms of *Colletotrichum fructigenum* (Berk.) Vassil. (Vassiljewski & Karakulin, 1950). Von Arx's opinion that this fungus is a synonym of *Colletotrichum gloeosporioides* is of course not sustained.

#### SUMMARY

The fungus which causes anthracnose of olives in South Africa was found to be a form of *Gloeosporium fructigenum* Berk. It has been given the name of *Gloeosporium fructigenum* Berk. f. *chromogenum* Gorter form. nov. [=M. C. Goldsworthy's chromogenic strain of *Glomerella cingulata* (Stoneman) Spauld. & v. Schrenk loc. cit.]. *Gloeosporium olivarum* Alm., which was originally described as the cause of olive anthracnose in Portugal has been renamed *Gloeosporium fructigenum* Berk. f. *olivarum* (Alm.) Gorter comb. nov.

Evidence has been presented that olives are not only subject to anthracnose diseases caused by the above mentioned fungi but also by two varieties of *Glomerella cingulata* viz.: *G. cingulata* (Ston.) Spauld. & v. Schrenk var. *brevispora* Wr. from apples and *G. cingulata* (Stonem.) Spauld. & v. Schrenk var. *crassispора* Wr. (= *Colletotrichum gloeosporioides* Penz.) from citrus.



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